MATERIALS RESEARCH AND DEVELOPMENT POLICY

HEARINGS

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS

OF THE

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MATERIALS RESEARCH AND DEVELOPMENT POLICY

TUESDAY, MAY 17, 1983

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:30 a.m., in room 2318, Rayburn House Office Building, Hon. Dan Glickman (chairman of the subcommittee) presiding.

Present: Representatives Glickman and McCandless of the Committee.

Also present: Representative Kogovsek.

Mr. GLICKMAN. The hearing will come to order.

It is a pleasure to begin this series of hearings on a subject that is key to our very survival as an industrialized, technological society. Namely, how do we provide, both now and in the future, for our strategic and critical materials needs?

Virtually every important industry in America needs an abundant supply of raw materials to provide and produce the variety of products that sustains our way of life. Yet the United States is becoming increasingly dependent on foreign sources for many of our most important raw materials. We are particularly vulnerable to supply interruption of certain minerals vital to national security. Also, the Nation's industrial base, including the capacity to process minerals and materials into useful products, is deteriorating—both in terms of facilities and a trained labor force. Yet, despite the obvious danger in these trends, we seem to be doing very little to develop an effective policy to insure sufficient supplies 20 or 30 years down the road. For this reason, the subcommittee is beginning an in-depth examination of a broad range of materials issues. In doing so, we hope to identify means for strengthening the Federal Government's materials research and development policy.

We plan first to examine the implementation of Public Law 96-479, the National Materials and Minerals Policy, Research and Development Act of 1980, and the resultant Presidential plan for materials and minerals. In that plan, the President described an organizational mechanism for dealing with the Nation's materials and minerals concerns. In this approach, the Cabinet Council on Natural Resources and Environment, chaired by Secretary Watt, serves as the materials policymaking entity and the Committee on Materials, COMAT, which reports to Dr. Keyworth, and functions as the coordinating body for Federal materials research and development.

Today we look forward to a status report on the activities of the Cabinet Council and COMAT over the past year. We have also asked the GAO to present its evaluation of the administration's implementation of the 1980 act. In addition, we have asked the Commerce and Defense Departments to present their views concerning the Nation's strategic materials needs.

Our hearings on May 18 will focus on the strategic stockpile and materials exploration. Testimony on May 19 will assess the advanced materials effort underway in the United States, particularly in the context of recent initiatives undertaken in Japan, West Germany, and other nations. During our final days of hearings, at a date to be announced later, industrial representatives will be asked for their views on the direction and stimulation required to lead the Nation's materials industries through this period of intense international competition.

Mr. Carney has asked that his opening statement be included in the record, which it will be.

[The statement of Mr. Carney follows:]

OPENING STATEMENT

HON. WILLIAM CARNEY

HEARING ON MATERIALS RESEARCH AND DEVELOPMENT POLICY

MAY 17, 1983

THANK YOU, MR. CHAIRMAN. I JOIN WITH YOU IN WELCOMING OUR DISTINGUISHED WITNESSES TODAY. FOR THE NEXT THREE DAYS, THIS SUBCOMMITTEE WILL INVESTIGATE THE U.S. POLICY ON MATERIALS RESEARCH AND DEVELOPMENT. TODAY, WE WILL HEAR FROM REPRESENTATIVES IN AGENCIES DIRECTLY INVOLVED IN IMPLEMENTING PUBLIC LAW 96-479, THE NATIONAL MATERIALS AND MINERALS POLICY, RESEARCH AND DEVELOPMENT ACT OF 1980.

I SHARE YOUR CONCERNS TOO, MR. CHAIRMAN, FOR AN EFFECTIVE MATERIALS POLICY. OUR AVIATION, AUTOMOTIVE AND DEFENSE INDUSTRIES ARE AT THE MERCY OF COUNTRIES WHO HAVE HAD LESS THAN POLITICALLY STABLE HISTORIES. AND WHEN YOU CONSIDER THAT OVER 90% OF OUR COBALT, CHROMIUM, MANGANESE AND PLATINUM COMES FROM SOUTH AFRICA, I TRULY BELIEVE THAT WE MUST HAVE A POLICY THAT WORKS.

THE SUBJECT OF MATERIALS COVERS A LARGE RANGE OF ISSUES INCLUDING: STRATEGIC STOCKPILING; MINERALS EXPLORATION ON FEDERAL LANDS; AND, ADVANCED MATERIALS. EACH OF THESE ISSUES IS INTERRELATED; FOR EXAMPLE, WE MUST HAVE A SUITABLE STOCKPILE OF CRITICAL MATERIALS IN A FORM THAT CAN BE QUICKLY UTILIZED. CURRENTLY, THE U.S. IS SENDING ALMOST ALL OF ITS COPPER ORE OVERSEAS TO BE SMELTED. THIS PRACTICE HAS GRADUALLY

CREATED A SITUATION WHEREBY THE U.S. IS LOSING ALL OF ITS ABILITY TO PRODUCE COPPER.

IT IS ALSO ESSENTIAL THAT WE ACCURATELY CATALOG OUR EXISTING SUPPLY OF STRATEGIC MINERALS AND MAKE EVERY ATTEMPT TO RECYCLE THESE PRECIOUS MATERIALS. IT IS IMPORTANT FOR US TO TAKE A MINERALS INVENTORY OF OUR FEDERAL LANDS IN A WAY THAT WILL NOT COMPROMISE OUR ENVIRONMENT. THIS COULD POSSIBLY BE ACCOMPLISHED USING LANDSAT SATELLITE IMAGERY FOLLOWED BY DRILLING CORE SAMPLES AT POTENTIALLY RICH MINERAL SITES. THIS ISSUE WILL BE DISCUSSED IN MORE DETAIL IN TOMORROW'S HEARING.

FINALLY, MR. CHAIRMAN, WE MUST PURSUE AN AGGRESSIVE ADVANCED MATERIALS PROGRAM. NOT ONLY WILL WE DISCOVER NEW WAYS IN WHICH TO USE MUCH LESS OF THESE STRATEGIC MATERIALS, SUCH AS WITH HIGH STRENGTH STEELS, BUT WE MAY DISCOVER THE MEANS BY WHICH TO USE NO STRATEGIC MATERIALS. CERAMICS AND COMPOSITE STRUCTURES ARE JUST TWO WAYS TO REPLACE CRITICAL MATERIALS-DEPENDENT COMPONENTS IN AEROSPACE, AUTOMOTIVE, AND DEFENSE PRODUCTS.

I LOOK FORWARD TO THE TESTIMONY FROM OUR WITNESSES. THANK YOU.

Mr. GLICKMAN. I might mention that, in this era of high technology and in developing a Nation's industrial policy, I guess it is extremely important that we deal with the basic issues—do we have the raw materials or materials, or both, to provide that evolution into an employment base in this country in the next century which will retain this country as an eminent industrial power in the world. I think these hearings will prove invaluable in dealing with some of the larger issues.

I might mention that our first speaker today will be our colleague, the Honorable Ray Kogovsek of Colorado, who sits on the House Interior Committee, and I think has taken the lead in this Congress on a variety of materials and minerals policies.

After Mr. Kogovsek, Dr. Keyworth will be our first witness. Mr. Sprague with the GAO will testify second. Then we will go to Mr. Miller of the Department of the Interior, Mr. Donnelly of the Department of Defense, and Mr. Wilson of the Department of Commerce.

So we will proceed now. It is a pleasure to welcome our colleague from Colorado, Mr. Kogovsek.

STATEMENT OF HON. RAY KOGOVSEK, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF COLORADO

Mr. KOGOVSEK. Thank you, Mr. Chairman, and thank you for your kind invitation to testify and participate in your oversight hearing on materials and minerals policy. I want to commend you and the members of your subcommittee for the continued work and interest towards achieving a national policy on this subject.

The passage of the National Materials and Minerals Policy Research and Development Act of 1980 was a landmark achievement. It was the first legislation in 10 years, since the 1970 Mining and Minerals Policy Act, that placed a direct focus on the importance of materials to our society.

President Reagan's minerals and materials program plan of 1982 was in response to the mandate in your legislation. Unless Congress continues to monitor the progress of policy implementation, I fear that minerals and materials problems will once again be placed on the back burner. There is no question of the importance of minerals and materials to our economy and our national security.

Over the years, many studies have been prepared which all reflect the fundamental premise that an adequate supply of minerals and a health industrial base are essential to our society. Most of those studies offered recommendations for a more stable governmental framework for reviewing minerals problems.

Unfortunately, the progress in making changes has been slow, at best. Our Government remains crisis motivated. Rather than advance preparations of alternatives, we wait for a crisis to determine a course of action. The energy crisis represents a classic example.

The consequences of a mineral supply cutoff would be much more devastating to this country than most people realize. Imports of over 50 percent of 24 strategic and critical minerals should raise doubts as to the security of a continuous supply. For example, we

import 88 percent of our chromium and 85 percent of our platinum. When I look at the statistics that 99 percent of the world's known resources of chromium are located in Southern Africa and 87 percent of the platinum group metals are located in the Soviet Union, I become concerned.

We hear statements that the stockpile will provide the materials during a national emergency. I am not heartened at this response. We must not view the stockpile as panacea for our minerals problems. The current stockpile falls far short of the goals for almost all of the strategic and critical minerals. Of course, efforts are underway to purchase additional materials, but realistically, it will be years and years before those goals are reached.

In conjunction with efforts to replenish the stockpile, we should explore our public lands to determine potential mineral resources. Granted we will never be mineral self-sufficient, but to never know what minerals we may have could be a costly mistake.

Aside from import dependence and lack of information on our public lands, we are facing a decline in our industrial base. The ferroalloy industry is operating only 8 of 84 furnaces, and only 10 of 25 plants are open. This industry is vital to our national security and, yet, without some changes in Government policies, it will not exist in a few years. Our copper ores are being exported for smelting and refining and, thereby, weakening our domestic capabilities. This downward trend must be reversed.

The statement of policy contained in President Reagan's program plan of 1982 is admirable. I quote, "It is the policy of this administration to decrease America's vulnerability by taking positive action that will promote our national security, help ensure a healthy and vigorous economy, create American jobs and protect America's natural resources and the environment." I concur with that intent.

However, I still find fragmentation, uncoordination, and a lack of central focal point. The Cabinet Council on Natural Resources and Environment, which was set up to coordinate minerals and materials issues, simply does not do the job. First, it cannot provide a long-term permanent system, it may be dismantled as quickly as it was established. Second, the members of the Cabinet Council are busy with their individual departmental jurisdictions and programs. They cannot provide a sole focus on materials policy and policy conflicts, nor can they provide the day-to-day management functions necessary to implement a material and mineral policy.

Mr. Chairman, I introduced legislation, H.R. 626, the National Strategic Minerals and Materials Assessment Act, to establish by law a permanent managerial framework to coordinate and assess strategic materials and minerals. A hearing was held on May 10 by the Interior Subcommittee on Mines and Forest Management and Bonneville Power Administration on my legislation. The testimony and dialog at that hearing made me even more aware of the necessity of that legislation.

I would like to work with you, Mr. Chairman, and the members of this subcommittee in modifying H.R. 626 to incorporate your ideas for policy coordination which is essential to a national strategic and critical minerals and materials policy.

I thank you for this opportunity to be with you this morning, and I look forward to a good hearing.

Mr. GLICKMAN. Thank you very much, Mr. Kogovsek, particularly for your points in which we relate minerals and materials together, because minerals are of no worth unless they can be made into something. That, of course, is how it relates to our entire industrial base.

Mr. McCandless, do you have any opening statements?

Mr. MCCANDLESS. No, Mr. Chairman.

Mr. GLICKMAN. Ray, just feel free to stay and and be part of the question and answer sessions.

Mr. KOGOVSEK. Thank you, Mr. Chairman.

Mr. GLICKMAN. I would like to welcome Dr. George Keyworth. I think that you have just come back from a trip to the Far East. I hope that the jet lag is beyond you. We appreciate that you are our leadoff witness here today.

Your statement, as well as the statements of all of the witnesses, will be made a part of the record in their entirety, so you may feel free to summarize if you wish.

STATEMENT OF GEORGE KEYWORTH, DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY, EXECUTIVE OFFICE OF THE PRESIDENT, ACCOMPANIED BY MURRAY A. SCHWARTZ, POLICY ANALYST, OFFICE OF SCIENCE AND TECHNOLOGY POLICY, EXECUTIVE OFFICE OF THE PRESIDENT; AND THOMAS PESTORIUS, SENIOR POLICY ANALYST, OFFICE OF SCIENCE AND TECHNOLOGY POLICY, EXECUTIVE OFFICE OF THE PRESIDENT

Dr. KEYWORTH. Thank you.

Chairman Glickman and members of the subcommittee, I am very pleased to be here today to describe progress made in implementing the President's National Materials and Minerals Program Plan, which was submitted to the Congress on April 5, 1982, in response to Public Law 96-479.

Last year, shortly after that plan was submitted, my staff and I spoke with concerned committees in both the House and the Senate about the vital relationship of materials to our industrial economy—both supplies of raw materials themselves and advances in the science and technology of materials. The administration continues to share this concern with you and other Members of Congress. The Federal Government does have a broad role in materials, and we are determined to minimize impacts on national security because of dependence on foreign sources for critical and strategic materials, and also to assure our lead in developing advanced materials for tomorrow's technology.

Last year I described how the President's plan was prepared by the Cabinet Council on Natural Resources and the Environment together with the concerned departments and agencies. This first materials and minerals policy covered a wide range of issues. It emphasized the critical role of minerals and materials to our economy, national defense, and standard of living. It delineated the need of the Federal Government to concentrate its R&D efforts, generally on long-term, high-risk, and high-potential payoff activities of

wide generic application while leaving responsibility for the shorter-term, more applied R&D to the private sector.

In the area of research and development, the administration presented its plan to eliminate excessive and unnecessary regulations that discouraged private sector materials R&D, to increase government-industry coordination in materials R&D, to establish international contacts for the exchange of information on materials R&D, and to reconstitute the FCCSET Committee on Materials with OSTP to coordinate Federal materials and minerals R&D.

Let me now describe our progress in addressing those goals.

The past year has been active for the Committee on Materials, or COMAT. One of our major activities has been to develop an inventory of Federal materials R&D activities, and we will provide you with a copy of the inventory report as soon as it has been reviewed by FCCSET.

In addition to the inventory data which show that 15 agencies spent approximately $1 billion on research in fiscal year 1982. The report includes a number of other items which we think you will find of interest. These include a background on the history of Federal materials coordination efforts, the charter and composition of COMAT, and a proposed classification system for use in assessing the interagency materials research program.

Each of the agencies contributed to this initial inventory. We are now looking at ways to improve future inventories, especially for purposes of long-range assessment purposes. We would welcome any suggestions the committee may wish to provide.

One of the important COMAT activities during the past year has been to establish interagency technical task forces. For example, in response to the Department of Defense's concern that the national effort in welding technology was too fragmented, we set up a task force to work with the private sector in assessing national technology needs and improving Government-industry coordination. Its first joint meeting with the welding research council took place last month and was highly successful.

Another task force addresses the strategic importance of rapid solidification technology, a new area of materials science which needs the best coordination among the agencies and with industry. That group has already held a number of workshops with participation on a restricted basis.

A third task force on essential materials coordinates interagency R&D efforts to reduce our vulnerability to interruptions in the supply of important materials. This research is directed mainly to substitution and conservation.

A fourth task force, the interagency materials group, has existed for over a decade. It coordinates Government-funded materials research, particularly basic research in our universities. In recent years, this group has focused special attention on research instrumentation needs there.

OSTP has also played a major role during the past year in international cooperation involving materials technology. Following the economic summit last year in Versailles, the United Kingdom and the United States proposed materials science and technology as one of the research topics for international cooperation. Each of the

seven participating countries will submit specific research proposals following the Williamsburg summit at the end of this month.

Materials—specifically photovoltaics—was also one of the four areas proposed for cooperative research as part of the new United States-India program.

We also discussed possible cooperative research during our visit to China last week. Additional international cooperative research in materials is being pursued by such organizations as the Geological Survey, the Bureau of Mines, and the International Development Cooperation Agency's Trade and Development Program, as well as by other agencies.

As part of my office's effort to assess research needs, we asked the National Academy of Sciences to look at major opportunities for high payoff in materials science. Their report suggested opportunities to extend the frontiers of materials science and to increase the flow of materials that can lead to new and improved technologies.

I would particularly like to single out the importance to this field of the proposed center for advanced materials research at the Lawrence Berkeley Laboratory. We consider this center to be a prototype for fostering interaction and cooperation among academic, Federal, and industrial scientists that can have broad impact on American industry in coming years. We expect this type of center to improve the focus of research and speed the transfer of new knowledge about materials to the marketplace. Establishment of this center at Lawrence Berkeley Laboratory is also part of our effort to better focus the Federal laboratories' research on today's national problems.

My office has also taken direct action on specific materials issues during the past year when we felt a problem existed or was developing. Two examples are the national defense stockpile—which needed more attention than the interagency task force responsible for it was providing—and the ceramic engine program—which needed better coordination.

I won't try to summarize how the individual agencies met their respective obligations under the National Materials and Minerals Policy, Research and Development Act of 1980, but we have maintained oversight of their activities. Defense has pursued critical materials needs related to national security; Commerce has conducted two materials needs case studies, one on the aerospace industry and the other on the steel industry; and Interior is improving its information systems for assessment purposes, as well as increasing its research on critical and strategic materials.

I should also mention that, during the past year, the Cabinet Council on Natural Resources and the Environment has considered public viewpoints on a variety of materials-related issues. It is now establishing a Minerals and Materials Industry Advisory Committee. Some of its recent activities have included defense stockpile policies, particularly with regard to purchases and sales; the coal slurry pipeline issue; and the President's proclamation establishing an offshore exclusive economic zone in which the United States retains minerals and fishing rights. Representatives of this Cabinet Council also participate in COMAT.

As you are well aware, research is only one part of our materials needs problems. We also have to consider international trade, antitrust regulations, patents, small business opportunities, productivity and innovation, education, and more. These materials-related issues are also being addressed by the Executive Office of the President and the Federal agencies.

In closing, I want to emphasize that the administration is strengthening our materials research programs to make them more relevant to national needs. This is being done as part of our science policy, which focuses on insuring an adequate supply of well-trained scientists and engineers, making the Nation's industries competitive in a global marketplace and advancing the technological basis for our national security.

Mr. Chairman, this concludes my testimony. I would now be pleased to respond to questions from the committee.

Mr. GLICKMAN. Thank you very much, Dr. Keyworth.

I have a few questions for you. I would like to ask you first, who has the responsibility for coordinating materials research and development within your office?

Mr. KEYWORTH. John Marcum.

Mr. GLICKMAN. Are others involved, like the National Security Council or OMB? How does COMAT interrelate with all of this?

Mr. KEYWORTH. COMAT is certainly a committee that is responsible for coordination and, in that sense, most definitely within our own environment, the OMB is involved, the National Security Council is involved, as well as the other agencies in the Executive Office of the President.

Mr. GLICKMAN. Let me follow up on that. What is being done in the sense of developing a Federal program to respond to the Government-industry initiatives taken recently in Japan and West Germany and other countries in the area of advanced materials? Six of the twelve themes identified in the MITI Japanese industrial-based technology project are directed toward advanced materials. The MITI program obviously involves all sorts of cooperation with government, industry, academia and national labs. Are we not in danger of losing out in the advanced materials competition without a more deliberate approach to our materials R&D effort?

Dr. KEYWORTH. Mr. Chairman, as you well know, that is an extremely comprehensive question going far beyond the materials issue alone. Let me attempt to respond as best I can.

This issue addresses the fundamental question that is receiving so much public attention today as to whether this Nation needs to better plan its economy to develop a more encompassing industrial policy—in other words, whether we should seek to emulate the Japanese planned economy in order to better compete in the international marketplace. It is a very fundamental question in regard to the stress and renewed competition that we find ourselves involved in today.

I would simply say that the administration and I personally believe very strongly that, in the long run, we should try to encourage an environment in which the forces of free trade and free enterprise can function as effectively as possible. But I am realistic. Nobody operates in an environment of unperturbed free trade and

free enterprise today, and clearly the new forces we face in our competition with Japan must force us to embrace new solutions.

I believe, however, that the approach our administration has taken in trying to emphasize a very clear Federal role in both the support of long-term generic, fundamental, basic research—and in accepting that it is virtually a Federal trust to ensure that the manpower and expertise that an expanding economy and an evermore technology dependent economy will require will be there when needed.

Now, whether we should be emulating the Japanese and literally providing Federal support in a massive way for, for example, a ceramic engine, a major effort being supported by MITI, is a question that will perhaps be resolved in time. But I feel very, very strongly that today, with the Federal Government embracing a posture of supporting long-term generic research in the appropriate ceramics and the appropriate thermodynamics and the major engine manufacturing companies in the United States supporting the development of the engine itself, I think we have an ideal balance. I think we have an opportunity for the market forces to pull and, yet, I think the Federal Government is playing a very important stimulus role.

I am not saying, however, Mr. Chairman, that I think we are doing everything perfectly. I think you will notice in the budget the President submitted to the Congress last February a massive increase in the support of materials science in the Office of Energy Research, in the National Science Foundation, and in many of our other basic research funding agencies. We realize the importance of this issue, but I think we should be very, very careful before we attempt to embrace a role more appropriate for a planned economy.

Mr. GLICKMAN. I think, to followup on that, that you have got a real crisis of knowing which way to go now that is causing the administration and this Government great personal problems. On the one hand, you know we must compete with planned economies who do not operate in the kind of abstract purist scenario that perhaps some of the ideologs in this country would like to operate.

I perceive you to be a little more pragmatic than some others. I am reminded Senator Dirksen once said, "I am a man of principle, but my first principle is flexibility." I do believe that this Government has to show that kind of flexibility or we are going to lose out.

What disturbs me about materials policy is that the left hand doesn't know what the right hand is doing. I recall when DOE came in and talked about the new advanced materials laboratory at the Lawrence Berkeley Laboratory, and then we talked to NASA people. At the time, NASA, who had been doing great amounts of work in materials—I guess at their Lewis Center, and elsewhere—had no idea that this advanced materials lab was even being planned.

I submit that what has happened to date is that, even with your organizational changes, you have an unfocused effort at dealing with some of the long-term problems because you are not quite sure philosophically what the role of Government ought to be.

I wonder if you might comment on that.

Dr. KEYWORTH. I think we are all quite clear on what the role of Government should be. I thank you for your reference to my pragmatism. I would only comment further by saying that my pragmatism reflects the President's own views on this whole issue of trade.

We held, to my recollection, approximately a dozen Cabinet Council meetings as of last fall on the whole issue of our ability to compete internationally. The Business and Higher Education Forum, a group of academic and industrial leaders, was requested to pursue this as a study, as many other groups have. In fact, they will report their results to the President this week. We are deeply concerned about our ability to compete internationally and we are looking at it very pragmatically.

Your reference to coordination, Mr. Chairman, is a valid one, across the entire spectrum of the conduct of R&D in the Federal Government. However, we must contrast it to the alternative, the way many other countries do it: through a ministry of science or a ministry of research. I can simply say that, in the past at least, our system has worked more effectively than the system of any other nation in the world.

Mr. GLICKMAN. Of course, the key issue is priorities. We know from your COMAT project that we spend roughly a billion dollars annually on Federal materials research—that is a lot of money for materials research. Maybe half of that isn't being spent well. Who knows? Maybe we don't need to spend a billion dollars.

I guess the issue that I am concerned about is where we are going in the future in terms of the question of priorities.

Speaking of which, in the DOE authorization bill for 1984, this committee calls for the establishment of a materials commission to develop long-term priorities in materials R&D. What do you think about that? Who should have responsibility for materials R&D? This is a subject that I know that our committee has had some interest in.

Dr. KEYWORTH. The idea of a committee charged with examining the overall field of science and advising the Department of Energy is, of course, a very good idea, one I certainly endorse. The question of who should bear overall responsibility goes back to my original comment about how we conduct the process of science in this country.

I think we, at OSTP, do try to maintain as clear an overall policy reflecting the President's views as we possibly can. I think I would contend that we do have a clear research and development policy, clearer than this country has had in many years because the country needs a clear R&D policy more than it has needed one in many years.

Mr. GLICKMAN. How do you specifically feel about a Federal Materials Commission?

Mr. KEYWORTH. A commission or an advisory committee?

Mr. GLICKMAN. If I may read you the committee report:

The National Center for Advanced Materials issue raises a more general problem for the basic energy science programs, the need for improved long-range planning and priority-setting. The committee directs that DOE, in conjunction with the appropriate scientific advisory groups, to develop a long-range plan for research priorities, facilities construction and operation, including a clear delineation of respective DOE and National Science Foundation responsibilities in fields of common interest.

This, of course, is something the committee directed DOE to do. DOE just has a small piece of the pie here. What I am asking is what about some sort of a national materials effort in this area? Is that what you are supposed to do?

Dr. KEYWORTH. We certainly look at providing a coherent policy across the administration.

However, what you are addressing is the question of the whole materials program with its individual elements allocated to individual agencies.

Working with the OMB, we do attempt to do that. However, I know well the spirit of the recommendation by the committee, and I certainly endorse that. I do believe we need to draw upon the private sector, the academic community, and the available expertise in America, to take a long-range plan and help us to develop it. This is something I think the DOE is quite enthusiastic about.

If I may, I would like to comment specifically on the National Center for Advanced Materials that triggered this. The issue has been reasonably controversial within the technical community because of the way it evolved in the budgetary process.

Let me comment that no one disputes that we possess the best science, the best basic research, in the world, both quantitatively and qualitatively. We train the very finest scientists. We are very good at this.

We do have a problem, however, because other nations are better able to transfer the fruits of the research of their laboratories to the marketplace. We do have a technology transfer problem, and it is not only that U.S. technology gets into the hands of other nations, but it is also that we do not capitalize upon the fruits of our research as effectively as we could. Our scientific community has become more and more isolated from the needs of the Nation. We are trying to address this problem just as your committee is trying to address it.

One of the issues that has concerned us has been the effectiveness of the national laboratories in transferring knowledge about materials to the private sector. They represent an enormous resource. As you may remember, I asked David Packard to chair a committee of our White House Science Council to rather exhaustively look at this. The committee has spent a tremendous amount of time in the last year, and its draft report will be reviewed and completed later this week. The issue is a complicated one. The laboratories are an enormous resource, not only in terms of money, but in terms of critical manpower.

This National Center for Advanced Materials is an effort to better coordinate the needs of industry with the resources of a national laboratory—one that is unique because it sits on a major academic campus. It is a means by which we can, hopefully, draw upon the national expertise, not just at Berkeley, by any means, but national expertise in the entire academic community, and form a laboratory in which academic scientists, national laboratory scientists, and industrial scientists can cooperate on long-term research. This will be a mechanism by which students and faculty can flow into the industrial environment and vice versa.

In that sense, the Center has to be considered both with respect to our overall materials science needs and with what we are trying

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to do in developing an example for how the national laboratories can be much more effective.

Mr. GLICKMAN. That is fine, but that doesn't answer two things. One is the priorities question. I am reminded that the National Academy of Science sponsored the Field Report for astronomy which set the priorities over the next 10 years. I think we need something to set the priorities in materials science and related issues.

What troubles me is and I am not as hung up as others might be with organizational charts, who has responsibility for them. I think that these just tend to feed bureaucrats' paperwork, and I want to see things get done. I don't get too upset about interoffice problems on how this Advanced Materials Laboratory got started. I am aware there is a feeling that there was no peer review in this process, it was a top-down decision that was made in your office or somewhere. I am also aware that, at NASA, there is one of the most successful technology transfer programs in America. You and I have talked about this before. They really knew nothing about it and they are doing a lot of materials work, and they are a successful purveyor to this materials work, and in the process, the words "materials priorities" are not mentioned very much.

So it appears to me that this may be representive of the continuing problem of nobody really setting priorities. Maybe the National Center for Advanced Materials would be who you would expect to set those kind of priorities. But, to date, we still haven't got them.

Dr. KEYWORTH. I think the priority of the field of materials science itself is best testified to by the size of the budgetary increases we requested.

But you raise a very valid point: Where are the most promising areas in terms of major economic payoff with regard to the competitiveness I addressed before? That is a very good question, requiring a very careful analysis of the most promising technical areas. This question is a key element of our overall science policy which we are trying to answer with the assistance of the National Academy and the establishment of various advisory bodies in the independent agencies. I have made it an issue for our White House Science Council, one they are clearly looking at.

I think we are seeing more and more, though, in our budgets, a clear emphasis on those areas where the promise is greatest. For example, use of synchrotron light, as a means of studying the physics of surfaces, is a tremendous opportunity to improve our overall understanding of materials and their applications. It is an immensely rich, complicated, and rapidly moving field. But I certainly concur that there should be in each and every budget a clear-cut revealed statement of where we consider the greatest importance to be.

Mr. GLICKMAN. Thank you.

Mr. McCandless.

Mr. MCCANDLESS. Thank you, Mr. Chairman.

Dr. Keyworth, I am very impressed with this laboratory and science approach, and I think it is essential to try to find alternate materials which would last longer and wear better. But I have a concern about the basic raw materials aspect of our current tech-

nology and the availability of that, as outlined by previous comments by one of my colleagues.

I am reminded of the sophistication of the German war machine when we talk about the availability of key materials in Africa and Russia. They found alternate sources, and they seem to have found them rather rapidly, for such material as chromium and cobalt.

Using that as a beginning point, are we doing enough to locate these basic resources beyond those that are known to us in Russia and South Africa and other areas?

Dr. KEYWORTH. Certainly, Mr. McCandless.

First, let me say that I personally believe the era when we could clearly expect strategic independence is long gone. I think this question initially arose when we were addressing energy independence, and we realized that we operate in the world today as allies, as trading partners. If the United States has adequate energy supplies, for example, and Japan is being devastated by a shortage, I believe that the world economy and the allies all together suffer.

As far as materials, specifically there are a number of things that one can do. First of all, trying to develop materials that can be substitutes through application of high technology is something we are quite effective at. I am sure you realize the role composite technology is paying in replacing many very strong materials in aircraft, automobiles, and other areas. This is a clear example of where substitution can occur.

You refer specifically to chromium and cobalt. I have to address that two different ways. First, these are both elements that receive particular attention in looking at our national security stockpile. In fact, I recollect there was a major cobalt purchase within approximately the last 18 months because of cobalt's critical nature in steel alloys and other areas. But the Department of Interior is aggressively trying to identify Federal lands where major deposits of critically needed ores do exist and make the land available, when appropriate, to the private sector for development. I think that is a key issue because, as you well know, the Federal Government maintains a vast repository of land, much of which could be exploited by the private sector without in any way interferring with our wilderness or recreation areas.

Mr. MCCANDLESS. I was looking over Public Law 96-479 which addresses the area we are talking about, the availability of materials for national security. Are you satisfied with the progress that we have made since this act went into effect?

Dr. KEYWORTH. I wouldn't say I am satisfied. I think we should only be satisfied with perfection, and it is not by any means perfect.

In reality, I am at least pleased with the rate of progress and the attention that is being paid both to making more resources available and developing substitution materials that are appropriate. I think that very rapid progress is being made in the whole area of materials research.

Mr. MCCANDLESS. I detected an underlying, "If I had complete control, I might have done things a little differently, or maybe there are areas that we could address a little better." Do you have those kinds of thoughts?

Dr. KEYWORTH. Certainly, I do. Isn't that perhaps why Government is composed of so many different individuals? Of course, there are always things that I, as a scientist, might emphasize in contrast to someone else who is an engineer.

Let me underline what I did say. I do think the increased attention and importance to the whole area of materials science that have been occurring in this country are extremely important. Materials has moved from a relatively low-key research area into an area in the forefront of research.

If I might make a slight jest, within my own community as a physicist, I no longer hear materials science being referred to as dirt physics. Materials science has shifted to an exciting and very promising area in the forefront of science.

Mr. MCCANDLESS. Let me ask the same question in a different way. If you had a magic wand and you were able to do with it what you felt you needed to do acting in your capacity, what would you add to or develop in the way of policy or activities that are currently not a part of our current program in accomplishing the objectives of this act?

Dr. KEYWORTH. I think, first and foremost. I would try to implement exactly what we have attempted at the Berkeley facility, except in many more places, because there is an enormous amount of talent that can be applied to this technology transfer problem, and there are centers of real excellence—places like MIT, for example, Brookhaven, and others—and I believe we could, with proper discrimination, provide the leadership that would improve the overall quality and the interaction between the scientific expertise and the needs of industry

As far as the development of resources within the country, I think the job is being done extremely well by the Department of the Interior. And, I believe that we will see in the coming years an aggressive response to the Department of the Interior's initiatives on the part of American industry.

The pricing problem that we are all facing in the area of the health of America's mining industry is a devastating one. As a scientist, I am not sure I am the best qualified to testify to that, but we know what we are facing in copper, uranium, and many, many other areas, where other countries can, through the richness of their ore or the cost of their labor, set prices we can't compete with.

Mr. MCCANDLESS. Not too long ago, we were told that we should cut back on our nuclear power program because of the shortfall of uranium, and that we would be dependent upon foreign sources for this uranium if we continued in the direction that we were in developing that source of electrical energy. Now we are told that we have an ample supply of uranium but, for various reasons, we are not pursuing a course of nuclear power any longer.

Is there a parallel there in other resources where we say at this time that there is a shortfall, that we have to look at this from an entirely different point of view and, and then a year from now, we are going to come up with another answer which differ by 180 degrees?

Dr. KEYWORTH. I think that is inevitable when you try to predict the future in too specific a fashion. I think in the case of nuclear

energy, we are seeing, of course, the effects of supply and demand, as well as an overly constraining regulatory process. But, definitely, I do think the laws of supply and demand will put sufficient emphasis on various research areas such that when metals and materials become rare and, therefore, very expensive, research will be accelerated, allowing us to develop substitutes.

I think certainly the whole question of the ceramic engine is a perfect example of this. We worry inevitably about the future. We worry about certain weaknesses. But I believe there is an enormous restoring force under the laws of supply and demand that does allow us to respond.

Mr. McCANDLESS. Thank you, Doctor.

Thank you, Mr. Chairman.

Mr. GLICKMAN. Mr. Kogovsek.

Mr. KOGOVSEK. Thank you, Mr. Chairman.

I have a couple of brief questions for Dr. Keyworth. Doctor, in your testimony on page 2, you said that one of our major activities, as far as COMAT is concerned, has been to develop an inventory of Federal materials R&D activities, and you will provide us with a copy of the inventory report as soon as it has been reviewed. Can you give us an approximate time when the committee can expect to see that report?

Mr. SCHWARTZ. The report went out to the FCCSET Committee about a week ago for their review and comments.

They were given 2 weeks to reply. We should receive it within 2 weeks. I don't think the comments will be difficult or complicated, and we should have the report printed and out within a month.

Mr. KOGOVSEK. Thank you very much.

Dr. Keyworth, the Government policy on research and development is basically to cut back funding, except for long-term, high-risk generic R&D. Would you agree with me that that is an accurate characterization?

Dr. KEYWORTH. Excuse me. It was basically what kind of funding?

Mr. KOGOVSEK. Let me read it again to you, because it is an important question as far as I am concerned.

The Government policy on research and development is basically to cut back on funding, except for long-term, high-risk generic R&D.

Dr. KEYWORTH. I would say that is an excellent general approximation. There clearly are specific areas where the Federal Government does have a different role—nuclear energy is an example—and there are particular reasons for that, regarding history, regulatory, environment, and so on.

But in general, if I may put it another way, we believe it is essential to delineate between the role the Federal Government should maintain and the role the private sector should maintain. Yes, we believe basic long-term, high-risk research, is appropriate for Government, and we believe that market-dominated, near-term applied research is appropriate for the private sector.

Mr. KOGOVSEK. If we have agreement on that statement, what person reviews all of the R&D programs to coordinate this limited amount of money in the most efficient and productive manner? In other words, who decides what money goes for what project?

Dr. KEYWORTH. Of course, the individual agencies operating under policy guidance from the White House and from their own Cabinet members are so charged, item by item, proposal by proposal, facility by facility. My office is responsible for the overall coordination among those agencies. And, the OMB, in setting priorities relative to the entire Federal Government, works very closely with us.

Mr. KOGOVSEK. If you had to name a person, could you do that?

Dr. KEYWORTH. An individual person?

Mr. KOGOVSEK. Yes. Or an individual position. Is it OMB? Is it you? Is it Jim Watt? Is it the President?

Dr. KEYWORTH. At the risk of being egotistical, I suppose it is probably my responsibility as much as anyone else's.

Mr. KOGOVSEK. You make those decisions as to what money goes to what projects?

Dr. KEYWORTH. Wait a minute. At a certain level, I make those decisions. I already said that if we are talking about an individual grant of $50,000, I certainly don't get involved. There are people who are far better equipped than I to address an individual local area.

However, if we are getting into the policy arena, such as the National Center for Advanced Materials at Berkeley, or something that is a very, very major part of the budget, then I get very intimately involved, and the question of a allocation of a resource and policy become essentially identical.

Mr. KOGOVSEK. So it would be you more than, say, David Stockman?

Dr. KEYWORTH. Dave and I work closely together. Dave asks me for advice and recommendations on most items involving science and technology. In this sense, I would say we have an outstanding working relationship with OMB.

Mr. KOGOVSEK. Doctor, you mentioned the Berkeley facility. Can you, in one or two sentences, describe that assignment? What does the Berkeley facility do?

Dr. KEYWORTH. It will be a center in which broad areas of materials science particularly important to industry today or of particular long-term promise can be pursued in an environment where academic scientists, relatively isolated from industry in general, and industry and Government scientists who, unfortunately, are probably even more isolated from industry—can interact, understand each other's needs and problems, and utilize their bulk expertise.

If you wish, it is a cooperative venture in the areas of maximum need as identified by our industries and areas where our scientists indicate there is maximum promise.

Mr. KOGOVSEK. Thank you.

That is all, Mr. Chairman.

Mr. GLICKMAN. Dr. Keyworth, I would just like to mention something. I don't know if you have had a chance to read the GAO's testimony. They are coming after you, and they do not treat you very kindly. I would like to summarize what they say. It is basically four things.

One, according to the Executive Secretary of COMAT, or the Council on Materials, they were not involved in determining the

need for the new advanced materials lab, and not yet formulated a position on whether such a gap currently exists. I am not going to get into the merits of that decision, but it strikes me strange that the chief institutional organizational mechanism for determining materials policy wasn't involved in the decision to establish the laboratory.

I am going to give you a chance to respond to all of these things, either verbally or in writing, but that bothers me a little bit.

The second thing they say is that the President's program plan approved by the Cabinet Council does represent a first step in developing a legislative policy, but they say it does not adequately address the 1980 act's policy because, one, it emphasizes minerals as opposed to materials; two, the primary focuses are on national security aspects, the dependency needs and, therefore, ignores other issues which are not directly defense related; and third, even though the plan focuses on national security, it does not develop an approach to measure the magnitude or degree of U.S. vulnerability to supply disruptions or sharp price increases in given nonfuel mineral and material markets to determine what the proper Federal role should be.

That is a fairly significant blast at the plan to date. You may want to respond in writing specifically after you have had a chance to look at the testimony, but I wonder if you have any comments now.

Dr. KEYWORTH. Let me make one quick comment, and maybe take a blast at GAO.

I think they are guilty of some bureaucratic naivete in the first comment when they claim that COMAT was not involved. The committee of COMAT was not involved. On the other hand, John Marcum, other members of my office, other agencies' representatives on COMAT, and I, were directly involved in the development of NCAM. So the same people were involved, even if the committee was not. I do think there is continuity of intellectual capabilities here.

In regard to the other three items, first of all, I think emphasizing materials versus minerals is just fundamentally false. When I claimed that we have introduced massive requests for increasing R&D, that very much addresses the availability of materials.

Second, they are absolutely correct in saying we place first emphasis on the national security aspects here. I think this comes simply from the statement the President has made many times when he states clearly that the first responsibility of any nation is to provide security for its people. This is a first priority.

Third, I think, we are assembling the information necessary to enable us to clearly identify areas of greatest vulnerability. On the other hand, I think the screams and cries continually voiced, saying that we will be cut off in the near future from one critical need or another—well, from the perspective of history, those have almost invariably been overemphasized. Let me say that I strongly discount the sort of response that suggests that the world is coming to an end because of a shortage of chromium or something else in the year 1992. I do think we are sensitive to relative degrees of vulnerability. We are assembling the information to better understand this. In this sense, I will let GAO respond later to my comments.

Mr. GLICKMAN. I would think that it may be useful, if you deem it necessary or appropriate, we would be glad to get a response statement from your office on the specifics of your statement.

One other thing that they talk about is you not having prepared the annual assessments of national materials needs related to scientific and technological changes over the next 5 years, as required under the act. I would just make the point that budgets are a year-to-year situation, and I do think we need a priorities assessment looking beyond individual budgets. You have improved the budgets. I am not going to say that you have retrogressed on a lot of the budget issues. But that was the intent of the National Academy of Science's Field statement on astronomy. I would hope that we could get the same kind of thing on materials-related issues from you as well.

I want to thank you for coming here. I appreciate your candid and thoughtful remarks.

Dr. KEYWORTH. Thank you very much.

Mr. GLICKMAN. Our next witness is Mr. John Sprague, Associate Director of the Resources, Community, and Economic Development Division of the GAO.

Mr. Sprague, it is a pleasure having you here.

I didn't ask Dr. Keyworth to identify the people with him. If you want to identify any of your copeople.

Dr. KEYWORTH. On my right was Thomas Pestorius; and on my left was Murray A. Schwartz, a policy analyst in my office.

Mr. GLICKMAN. Very good. Thank you, Doctor.

Mr. Sprague, it is a pleasure to have you here.

STATEMENT OF JOHN SPRAGUE, ASSOCIATE DIRECTOR, RESOURCES, COMMUNITY, AND ECONOMIC DIVISION, U.S. GENERAL ACCOUNTING OFFICE; ACCOMPANIED BY CHARLES COTTON, SENIOR EVALUATOR, U.S. GENERAL ACCOUNTING OFFICE; JOHN R. HADD, GROUP DIRECTOR, U.S. GENERAL ACCOUNTING OFFICE; AND RICHARD KASDAN, OFFICE OF GENERAL COUNSEL, U.S. GENERAL ACCOUNTING OFFICE

Mr. SPRAGUE. Thank you, Mr. Chairman.

Let me identify, as you suggested, the people with me. On my immediate right is Mr. Charles Cotton, a senior evaluator in the same division I am with; on my far right is Mr. John Hadd, who is a group director also in our division; and on my immediate left is Mr. Richard Kasdan from our Office of General Counsel.

Mr. GLICKMAN. As I said before, your entire statement will appear in the record. It is not very long, so if you wish to read it, that is fine.

Mr. SPRAGUE. Mr. Chairman and members of the subcommittee, we appreciate this opportunity to comment on issues concerning the National Materials Policy, Research and Development Act of 1980, Public Law 96-479.

Section 5 of the act required the President to submit a program plan and report to the Congress by October 21, 1981. According to the act, this plan was to include programmatic and budgetary proposals and organizational structures providing for materials and minerals policy analysis and decision determination within the Ex-

ecutive Office of the President and interagency coordination at the Cabinet level. Other sections of the act also assign certain major coordination responsibilities to the Executive Office.

Consistent with your invitation, my remarks will concentrate on whether the coordination and policymaking promised in the President's program plan are being effectively implemented. Our work to date, undertaken at the request of committee Chairman Fuqua, indicates that the organizational approach taken by the administration may not provide for effective coordination and decision determination. Moreover, we believe that the President's program plan does not adequately address the act's policy to promote an adequate and stable supply of materials. These issues will be addressed further in our report to the committee chairman to be issued after obtaining and incorporating appropriate agency comments.

The President, in his materials and minerals program plan, formally assigned responsibility for coordinating national materials policy to the Cabinet Council on Natural Resources and the Environment, one of the five interagency Cabinet Councils established by the President in February 1981. The plan states that the Cabinet Council will insure high-level consideration of important materials policy issues on a timely basis, with the capability of prompt action on such issues by the President. The plan does not mention what role, if any, the Executive Office of the President will play.

The Cabinet Council may not be able to effectively implement the act's interagency coordination requirements since it lacks both representative membership and a procedure for bringing the materials-related issues and problems of nonmember departments, agencies, and private industry to the Council's attention. Further, the Council has not been effective at implementing policy decision determinations.

First, the Council lacks representative membership. For example, it does not include the Secretary of the Department of Defense which has significant materials responsibilities and related research and development programs. Furthermore, subcabinet agencies are excluded. Some of these agencies, such as the Federal Emergency Management Agency and the Environmental Protection Agency, have major materials responsibilities and programs.

The President's program plan was developed by the Strategic Materials Task Force, an interagency working group comprised of officials from 15 executive branch departments and agencies. After the plan was approved, the task force was unofficially disbanded. Therefore, there is now no procedure for bringing the materials-related issues and problems of nonmember departments, agencies, and private industry to the Council's attention.

Finally, although the timeframe for implementing the act has been limited, early indications are that the Council has not been effective in providing active continuous leadership and direction. For example, the plan reestablished the Committee on Materials, COMAT, comprised of Assistant Secretary level representatives from Federal departments and agencies concerned with minerals and materials and chaired by the Office of Science and Technology Policy's Assistant Director for Natural Resources. The plan tasks COMAT with coordinating Federal minerals and materials re-

search and development activities and the Council with providing policy resolution of materials research and development questions.

In a report scheduled to be released shortly, COMAT will provide an inventory of Federal minerals and materials research and development. This inventory, coupled with administration policy, is to be used to recommend redirection, where appropriate, of Federal minerals and materials research and development programs. In the interim, however, the Department of Energy has proposed a major new initiative in materials sciences included in the President's fiscal year 1984 budget. The overall goal of this research initiative is to improve linkages among academic, national laboratory, and industry sciences for the future advancement of high technology industries—a responsibility the President's program plan delegated to COMAT.

According to COMAT's Executive Secretary, COMAT was not involved in determining the need for the new initiative and has not yet formulated a position on whether such a gap currently exists. The Council has not addressed, much less resolved, this question and the Energy initiative is not being developed within the context of an overall national minerals and materials research and development program.

We believe that this and other examples we have identified show that the Council lacks the authority to effectively direct and coordinate materials programs. Moreover, although we believe that the Cabinet Council may assist the full Cabinet or Executive Office in interagency coordination, we do not believe that it can effectively assume the decision determination responsibility explicitly assigned in the act to the Executive Office of the President.

Our work to date also indicates that while the President's program plan, approved by the Cabinet Council, represents a first step toward developing the legislative, budgetary, and programmatic proposals required by the act, it does not adequately address the act's policy "* * * to promote an adequate and stable supply of materials necessary to maintain national security, economic well-being and industrial production * * * ." This is due primarily to three deficiencies in the program plan.

First, the plan emphasizes minerals as opposed to materials problems and corresponding solutions, such as land availability and minerals data. Other components of materials systems, such as processing capacity and consumption which require Federal attention and possible intervention, are not adequately addressed.

Second, the plan's primary focus on the national security aspects of dependency tends to obscure or ignore other issues which, while not directly defense related, affect the act's other long-term goals of economic well-being and industrial production. For example, the plan does not address related problem areas cited in the act, such as the need for energy conservation in materials production, impacts on supply from foreign competion, lack of technically trained personnel, and possible need for adjustments in tax policies.

Third, even though the plan focuses on national security, it does not develop an approach to measure the magnitude or degree of U.S. vulnerability to supply disruptions or sharp price increases in given nonfuel mineral and material markets to determine what the proper Federal role should be.

These limitations may remain unresolved since the act does not require continuing analysis and updates of the program plan. Also, there appears to be a difference in perception between the Congress as reflected in the act and legislative history and the administration as reflected in the program plan concerning the approach to providing effective minerals and materials coordination and policy decision determination. The act also requires that the Office of Science and Technology Policy prepare annual assessments of national materials needs related to scientific and technological changes over the next 5 years. To date, the annual assessments have been given a low priority by OSTP and have not been prepared.

In summary, we believe that four issues require further attention if the goals of the 1980 act are to be realized.

First, there is the need to assure full coordination and consistent departmental implementation of all basic materials policy decisions.

Second, although the President's program plan represents a first step, there appears to be deficiencies in the program plan which preclude it from adequately addressing the thrust of the act's policy.

Third, the Office of Science and Technology Policy has not prepared the annual assessments of national materials needs related to scientific and technological changes over the next 5 years, as required by the act.

Finally, the 1980 act does not require that the program plan be periodically updated and resubmitted to the Congress.

Mr. Chairman, that concludes my statement. I welcome any questions the subcommittee may have.

Mr. GLICKMAN. Thank you, Mr. Sprague.

I guess one of our concerns up here is the lack of the administration's commitment to a national materials policy. In your statement on page 6, you state, "The act also requires OSTP to prepare annual assessments of national materials needs related to scientific and technological changes over the next 5 years. To date, the annual assessments have been given a low priority by OSTP and have not been prepared."

Wouldn't it be more accurate to state that OSTP has chosen to ignore complying with the act and not supply us with the assessments?

Mr. SPRAGUE. That is an interpretation that we are not prepared to give. The facts are that they have not prepared it, and it is our understanding that, because of priorities within the office, they just haven't been able to get to it.

Mr. GLICKMAN. But as far as you read the statute, the statute requires those assessments.

Mr. SPRAGUE. That is correct, yes.

Mr. GLICKMAN. So if the assessments haven't come, they have ignored the statutory language.

Mr. SPRAGUE. I suppose that is correct, Mr. Chairman.

Mr. GLICKMAN. OK.

You indicate in your statement that the Secretary of Defense is not represented on the Cabinet Council. Are the interests of this

Department—I guess the DOD would be defense materials related—served without representation on the Cabinet Council?

Mr. SPRAGUE. I might as well try to get one thing up front here, because I think it is going to affect a lot of this. Our concern here is the intent of the act was to provide a coordinated, well-structured approach to materials policy. We are trying to say that such an approach doesn't exist. Again, it is our view that that is not the way the act intended to have a materials policy work.

Mr. GLICKMAN. Your interpretation would be that the current implementation of the act is an ad hoc approach?

Mr. SPRAGUE. I think much of what we are saying is there are many ad hoc features to it, yes, sir.

Mr. GLICKMAN. Mr. McCandless.

Mr. MCCANDLESS. Thank you, Mr. Chairman.

Mr. Sprague, I would like you to take me through some of the steps that GAO used in the process of arriving at your conclusion. For example, you are doing an administrative audit on a piece of legislation and coming up with some conclusions, which is your responsibility. In so doing, when you have arrived at your preliminary conclusions, do you share those with the Department, office, or other people involved for any feedback that might alter your original assessments?

Mr. SPRAGUE. Yes, sir, that is our policy. I did say in my statement that we had not yet provided it to the agencies. We do plan to do so in the near future.

Mr. MCCANDLESS. You are coming up with some rather sharp conclusions that you are sharing with us which we are supposed to consider in whatever action we ultimately take. Do I understand from your response that these conclusions—the Council lacks representative membership and a couple of others here—that these conclusions have not been shared with those who have administrative responsibility, prior to your coming here and testifying?

Mr. SPRAGUE. They have not been shared with those people; that is correct. But we feel fairly firm in our position here. Otherwise, we wouldn't be up here to testify on it. We would certainly provide their views on it, eventually, in the report when we do get them back.

Mr. MCCANDLESS. Without any disrespect to you or any of the members of your organization, we are all humans and sometimes we err, yet, when we publish a document, that document tends to take on validity sometimes beyond the printed word simply because it is on a piece of paper.

Wouldn't you think it would be prudent for these purposes to discuss your findings at a preliminary level with any department, irrespective of what it was, to get some of their responses which might result in enlightenment on the part of the investigator who would come at this with a little different direction?

Mr. SPRAGUE. As I said earlier, we have not yet formally provided this to the agencies for comment. We will do so. Of course, in developing our information, we have talked with a number of administration officials and explained to them what we were doing and asked them a series of questions, interviewed them, gave them some idea of where we were coming from, and pulled their information together.

It is our policy also to provide each agency, when we go in, with an entrance briefing to inform them of what we are doing and why we are doing it and what are our ultimate objectives, so they are not completely in the dark on what we are doing. In many informal ways, we have gotten their positions and viewpoints on what we are saying in here, it is just that we haven't gone through the formal process yet.

It is also our responsibility to try to be as responsive to the needs of Congress as possible. The Congress is having a hearing here, and we were asked to testify, and we are trying to provide the best information we have at this time.

Mr. McCandless. In my short time here in Washington, having spent 12 years in local government, I find that there is a common thread that might reflect what we have here, and that is that one department goes at another department, which certainly has the responsibility necessary for whatever the function may be, but there is no discussion of what the preliminary or ultimate results of that review are. Then they are published and we get into a long dissertation about the accuracy, or the lack thereof, of the final report. This takes inordinate numbers of hours of staff time, as well as administrative time.

It is this concern that I have, and the reason I wanted to share this with you. I don't think you see too much of that in lower levels of government because there is more of a desire to want to work together for the common cause, rather than to just file a report.

Thank you.

Thank you, Mr. Chairman.

Mr. Glickman. Thank you, Mr. McCandless.

Mr. Kogovsek.

Mr. Kogovsek. Thank you, Mr. Chairman.

Mr. Sprague, your statement and report indicates that the intent of Congress has not been fully implemented. Let me ask you if you are able to comment on either my bill, H.R. 626, or other bills by Congressman Young and others to legislate this specific coordinated assessment plan? Have you had a chance to look at either Don Young's bill or my bill?

Mr. Sprague. No, sir. I am not familiar with the details of either one of them.

Mr. Kogovsek. OK.

Mr. Keyworth, Mr. Miller and Mr. Donnelly, as I look at their testimony and as I listened to their testimony, every one of them testifies that they are doing the job. My question to you is would you comment on how they can all be doing the job and, yet, you and I are saying that additional measures are necessary?

Mr. Sprague. The only comment I could make on that is that we are trying to give our interpretation of how the act is being carried out, and it is through the program plan, and the President specifically delegated the role of coordination to the Cabinet Council. That is not to preclude individual agencies from carrying on lots of materials work, R&D or otherwise. I would presume the intention was that, certainly in the major aspects of it, that the Cabinet Council would be aware of it, would see that all of the proper agencies had a chance to comment on whatever issues were coming up,

and at least played a role in a decision as to whether it was good, bad, or indifferent to go forward with it.

It has been our judgment so far that this is not happening on any sort of a regular scale. I just say that, since somebody said something about our testimony, I will throw it out that, from whatever I have read from most of the other testimonies here, they are mostly reciting their own agency's efforts. There is very little mention made, other than in passing to the Cabinet Council which the President stated is to be the focal point of materials policy.

Mr. KOGOVSEK. I appreciate that.

Let me follow up. In your summary, you say that four areas need to be addressed: No. 1, better coordination and implementation; No. 2, the President's plan has deficiencies that preclude proper implementation of the act; No. 3, the Office of Science and Technology has not prepared the required assessment; and No. 4, the 1980 act does not require congressional update.

My question to you would be how can Congress correct this? Does this mean that we again must legislate?

Mr. SPRAGUE. We would probably deal with that further in our final report. To the extent that I get in that now, I would probably be out front in giving my personal opinion. I think one thing is obvious. If you are going to address the question of periodic updating, yes, the act would have to be amended in that case. I don't think there is any question about it.

Mr. KOGOVSEK. Do you believe that with all of these agencies doing things in different directions, a reprograming of funds could create this coordination without new budgeting appropriations?

Mr. SPRAGUE. I couldn't really address that, sir.

Mr. KOGOVSEK. Thank you, Mr. Chairman. That is all of the questions I have.

Mr. GLICKMAN. Let me just ask you a final question, Mr. Sprague.

What Cabinet-level departments are represented on the Cabinet Council?

Mr. SPRAGUE. The Interior Department, the Attorney General, Agriculture, Transportation, HUD, Energy, and Commerce and then it goes on to Vice President and Counselor to the President are also on it.

Mr. GLICKMAN. I understand that there is a Strategic Materials Policy Working Group on the Cabinet Council in which Commerce and Defense are represented; is that correct?

You may answer if you want to.

Mr. COTTON. There was the working group comprised of representatives from 18 different Departments and agencies. However, once the program plan was approved by the Cabinet Council, that working group was unofficially disbanded and, to our knowledge, has not met since. You are looking at over a year since that program plan was approved.

Mr. GLICKMAN. So there is no representation by the Defense Department?

Mr. COTTON. Nor by subcabinet agencies, such as FEMA and the Environmental Protection Agency, which must be involved in any type of materials-related policy analysis and decisionmaking.

Mr. SPRAGUE. That was our original point. Again, I stress ad hoc is always possible, but there is no structured way for them to represent themselves on that.

Mr. GLICKMAN. The Cabinet Council tends to have a minerals and land management orientation to it, because the Interior Department is the focus of it. I guess my concern, as reflected in your testimony, is that is only part of the total problem and requires some formal structure or you won't get the other input.

Mr. SPRAGUE. Yes, sir.

Mr. GLICKMAN. We thank you for your testimony and appreciate your coming down here.

Mr. GLICKMAN. Our next witness is Mr. Daniel Miller, Jr., Assistant Secretary for Energy and Minerals at the Department of the Interior.

Mr. Miller, it is a pleasure to have you here.

You might want to introduce for the record the gentlemen with you today. Your entire statement will appear in the record, and you may feel free to summarize it if you wish.

STATEMENT OF DR. DANIEL N. MILLER, JR., ASSISTANT SECRETARY FOR ENERGY AND MINERALS, U.S. DEPARTMENT OF THE INTERIOR, ACCOMPANIED BY DR. JOHN MORGAN, BUREAU OF MINES; AND DR. WILLIAM PRINZ, U.S. GEOLOGICAL SURVEY

Dr. MILLER. Thank you, Mr. Chairman.

Mr. Chairman and members of the committee, ladies and gentlemen, we are pleased to appear before you to provide a report on the Department of Interior implementation of President Reagan's National Materials and Minerals Program Plan and Report to the Congress which was submitted on April 5, 1982, in response to the National Materials and Minerals Policy, Research and Development Act of 1980—a measure in considerable degree of the work of this committee.

Mr. Chairman, I have with me today Dr. John Morgan on my left from the Bureau of Mines and Dr. Bill Prinz from the U.S. Geological Survey, who will be available to assist me perhaps during the question period.

At the outset, I want to make two major points, Mr. Chairman. First, neither minerals policy nor materials policy can exist in a vacuum. Minerals policy can only function as part of a broader materials policy; and materials policy, in turn, must be a part of still broader industrial policy; and industrial policy relates directly to the broad interrelated economic and national security policies.

Two, this administration believes strongly in the efficacy of the marketplace in fulfilling the needs of the normal economy and also many of the present needs of the national security sector as well. The ingenuity of the free enterprise system has raised the standard of living of the American people to the point that millions of people in the world would like to live here if they could or, failing that, look to us for technical and economic assistance and the protection of our farflung defense umbrella.

In light of the above, our primary efforts in the past 2 years have been directed at measures intended to encourage savings and investment, exemplified by the Economic Recovery Tax Act of 1981,

which facilitated the writeoff of industrial equipment and which provided additional incentives for research and development in the private sector.

In the Department of Interior, we recognize that adequate and reliable supplies of energy—declared to be a strategic and critical material in the Defense Production Act amendments of 1980—are essential to both the peacetime development of the U.S. economy and our national security. Energy supplies are essential to virtually all manufacturing and transportation, and the minerals and materials producing sectors of our economy are, themselves, major consumers of energy. For example, electricity in aluminum, magnesium, titanium, copper, and ferroalloys production; coal in steel, cement, pulp and paper production; and petroleum in agriculture and forestry and mining and petrochemicals for plastics.

Accordingly, in the year preceding the issuance of the April 5, 1982 report, we focused on measures available under existing laws to open more U.S. lands for exploration and development of energy sources: petroleum and natural gas, coal, oil shale and tar sands, uranium, hydropower, and geothermal energy. Secretary Watt moved promptly and resolutely to speed up leasing, to facilitate multiple use and sustained yield, and to lessen, where possible, the regulatory burden inhibiting resource development while still protecting worker health and safety and the long-term environmental and aesthetic values that we all agree upon.

The Nation is already seeing the positive results of those actions. Just a few years ago, about half of our energy came from petroleum, and half of that petroleum was imported. The people of the entire Free World endured rampant inflation caused by rising oil prices and uncertainties about the future while awaiting the next oil shock. Now the picture is brighter. Oil prices are declining, and the rate of consumer price inflation between December 1981 and December 1982 was only 3.9 percent, about one-third of the rate in 1980.

At present, there are no commercial shortages of materials. Indeed, markets for most materials are depressed and producers are strenuously engaged in promoting uses of traditional materials while seeking to develop new and improved materials for their customers. Nevertheless, we must not be complacent about the future. Some of our national security programs require highly-specialized materials for maximum performance. Because of that, the research arms of the Department of Defense, the Army, Navy, Air Force, Marines, the National Aeronautics and Space Administration, and the nuclear energy development staff of the Department of Energy, are working with their network of contractors, and spending hundreds of millions of dollars annually on the development of specific items of high-performance materiel which will embody the fruits of the forefront of materials research and development.

As set forth in the April 5, 1982 report, the administration reaffirmed the Committee on Materials, COMAT, under the direction of the Federal Coordinating Council on Science, Engineering and Technology, FCCSET, for the coordination of Federal materials and minerals research and development activities, and the Department of Interior is represented thereon by my office to keep us fully abreast of developments and problems in that area. Policy resolu-

tion of materials research and development questions is provided through the Cabinet Council on Natural Resources and Environment, chaired by the President, with our Secretary, Jim Watt, as Chairman pro tem.

The Cabinet Council on Natural Resources and Environment considers many issues which bear on the Nation's materials posture, not just those related to research. For example, the Council took the lead in formulating the administration's policy on ocean mining that lead to our December 1982 refusal to sign the Law of the Sea Treaty.

Subsequently, the Cabinet Council recommended that the President sign the March 1983 proclamation which established an Exclusive Economic Zone for the United States. This EEZ clearly asserts U.S. jurisdiction over the living and non-living resources of the area extending 200 nautical miles seaward from the United States and its overseas territories and possessions, including Puerto Rico and the Northern Marianas trusteeship. These actions are intended to make mineral and materials resources of the ocean available for satisfaction of U.S. needs.

Although we recognize that commercial development of undersea deposits of minerals will not happen in the next few years, we believe that the President's actions have laid the groundwork for the resolution of the problems of access and tenure which, in turn, will encourage the research and development efforts that must precede commercial exploration. Under our economic system, the hope of future profit is a powerful incentive to unleash the ingenuity of the private sector.

Turning now to a closer look at the materials research interests of the committee, let me report briefly on some of the work underway in the agencies under my immediate jurisdiction. Permit me to say that, as a professional geologist, it has been a high point of my career to oversee the U.S. Geological Survey, which was established in 1879, and which has been the model for virtually every other Geological Survey in the world.

Likewise, I am most pleased to have under my jurisdiction the Bureau of Mines, which was formed in 1910 from some elements of the Survey, and which, too, has been the model for like agencies in many other nations.

Together, these two scientific and technical agencies have covered every phase of the mineral cycle for nearly three-quarters of a century. The mineral cycle starts with topographic and geologic mapping, then comes exploration and development, then mining and concentrating, then smelting and refining—or other processing as in the case of ceramics—then metal and alloy development, then application and use and, finally, recycling or safe disposal.

The mineral sector of the economy is the inheritor of proud traditions. Some of our present technology is the lineal descendent of techniques that have been in use over 10,000 years ago, and the Survey and the Bureau have been working systematically, in concert with State and local governments, with foreign governments, international bodies, academia and the private sector to help advance the sciences of geology, geophysics, geochemistry, geobotany, hydrology, mapping, mining, metallurgy and ceramics.

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Mr. Chairman, in the prepared testimony that I submitted, you will find 17 specific examples, and I will not take the time to read those now.

Mr. GLICKMAN. Those will be included in the record. We appreciate you outlining those for us.

Dr. MILLER. Thank you, sir.

A recent development that I am sure you will find interesting is our establishment of generic research centers intended to focus research in academia, government and industry on specific areas of broad application in the minerals sector of the economy. These centers, managed for the Secretary of the Interior by the Bureau of Mines, are currently funded for more than $1 million each.

They include mine systems design and ground control, at Virginia Polytechnic Institute, with affiliates of Nevada, Alabama, Kentucky, Alaska and Idaho; comminution, at the University of Utah, with affiliates of Minnesota, Berkeley, Michigan, Colorado and New Mexico; pyrometallurgy, at the University of Missouri at Rolla, with affiliate of Purdue in Illinois; and mineral industry waste treatment and recovery, at the University of Nevada, with affiliates in Montana, Iowa, New Mexico and Idaho.

A fifth generic center devoted to the engineering aspects of respirable dust—a problem in many mining, metallurgical, ceramic and recycling operations—is currently being established. The generic centers should greatly facilitate concentration of effort, interchange of professors and graduate students, and assurance of our continuing to be in the forefront of the mineral science and technology field.

Your committee expressly inquired as to our policies for managing possible interruptions to supplies. As I indicated earlier in my statement, our basic policy is to rely to the maximum extent upon the marketplace for managing temporary displacements in peacetime, for we believe that the informed judgments of 233 million Americans acting to increase supplies, modify uses, and restrain panic demand are preferable to authoritarian bureaucrats using obsolete and incomplete econometric models to forecast the future. However, for defense emergencies, as distinct from peacetime perturbations, we have well established procedures in place.

Materials management in defense emergencies would take place pursuant to Executive Orders 10480 and 11490 under the Defense Production Act, Federal Register Document 67-1313, and Executive Order 12155 under the Stock Piling Act. The Department of the Interior is responsible for emergency readiness plans and programs for all nonfuel raw mineral materials. As set forth in detail in Federal Register 67-1313, the Department of the Interior is, in general, responsible for mines, concentrating plants, and refineries, and for the ores, concentrates, and other materials treated in such facilities.

The Department of Commerce is responsible for facilities and materials that are further along in the chain of processing and utilization, and it maintains the Defense Materials and Defense Priorities Systems to channel materials to defense and defense-related production.

Mr. GLICKMAN. Dr. Miller, we may have to leave by 12:15. Could you summarize, if possible. I want to make sure there is time for

questions for you and our next two witnesses. As I said, your entire statement will appear in the record. If there is anything you wish to summarize that would be useful to us, it would be appreciated.

Dr. MILLER. Let me conclude, then. In the event of a supply disruption, the first action to be taken would be to monitor exports, followed, if necessary, by export controls. The Export Administration Act of 1979 authorizes use of export controls to restrict exports detrimental to U.S. national security, to further U.S. foreign policy, or to protect the domestic economy from the excessive drain of scarce materials and to reduce the serious inflationary impact of foreign demand.

The Secretary of Commerce is charged with monitoring exports and contracts for exports of any nonagricultural good "when the volume of such exports in relation to domestic supply contributes, or may contribute, to an increase in domestic prices or a domestic shortage, and such price increase or shortage has or may have, a serious adverse impact on the economy or any sector thereof."

A worsening supply situation would require imposition of a system of priorities under title I of the DP Act, whereby rated orders would have to be filled first. If priorities proved to be inadequate, they would be followed by a system of allocations, also authorized by title I. The Bureau of Mines and the Department of Commerce would implement priorities and allocations in their respective area of responsibility.

At some point in a serious shortage situation, recourse to the strategic stockpile might be required. The Stock Piling Act provides for release "(1) on the order of the President, at any time the President determines the release of such materials is required for purposes of national defense; and (2) in time of war declared by the Congress or during a national emergency, on the order of any officer or employee of the United States designated by the President to have authority to issue disposal orders . . . if . . . required for purposes of national defense." To release stockpile materials, FEMA, in consultation with other agencies, including the Bureau of Mines, would prepare a justification and recommendation for the President's signature. On receipt of the President's authorization, the Office of Stockpile Disposal of GSA would release the materials to specified recipients.

Export controls, priorities and allocations, and stockpile releases, however, are only temporary measures of limited effectiveness. Any long-lasting supply disruption would call for supply expansion programs under title III of the DP Act. These would cover not only domestic deposits, but also deposits in reliable foreign sources. The Bureau of Mines would recommend needed mineral supply expansion programs to FEMA, which would then direct GSA to make the necessary contractual arrangements.

Mr. Chairman, that completes our formal statement.

[The prepared statement of Dr. Miller follows:]

Statement of

Honorable Daniel N. Miller

Assistant Secretary--Energy and Minerals

Department of the Interior

before the

Subcommittee on Transportation, Aviation, and Materials

Committee on Science and Technology

U.S. House of Representatives

Tuesday, May 17, 1983

Mr. Chairman, Members of the Committee, Ladies and Gentlemen:

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At the outset, I want to make two major points:

(1) Neither minerals policy nor materials policy can exist in a vacuum. Minerals policy can only function as part of a broader materials policy; materials policy in turn must be a part of still broader industrial policy; and industrial policy relates directly to the broad interrelated economic and national security policies.

(2) This Administration believes strongly in the efficacy of the market place in fulfilling the needs of the normal economy and also in meeting many of the present needs of the national security sector as well. The ingenuity of the free enterprise system has raised the standard of living of the American people to the point that millions of people in the world would like to live here if they could, or, failing that, look to us for technical and economic assistance and the protection of our far-flung defense umbrella.

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and use, and finally recycling or safe disposal. The mineral sector of the economy is the inheritor of proud traditions--some of our present technology is the lineal descendent of techniques in use over 10,000 years ago, and the Survey and the Bureau have been working systematically, in concert with State and local governments, foreign governments, international bodies, academia, and the private sector, to help advance the sciences of geology, geophysics, geochemistry, geobotany, hydrology, mapping, mining, metallurgy, and ceramics.

Some examples of work under way in the U.S. Geological Survey include:

- The National Mapping Program provides for improved availability, collection, analysis and dissemination of scientific and economic materials information by supplying basic and specialized cartographic and geographic data. Primary quadrangle maps at the 1:24,000-scale support domestic land development and management decisions in activities such as economic and industrial studies, location and development of transportation, evaluation of impact of natural disasters, and military and civil defense. Other maps derived from the primary quadrangle maps include intermediate-scale maps, small-scale, land use and land cover and special maps. These maps provide Federal agencies with the cartographic information for activities such as mineral resource

assessment and management, offshore leasing and military defense. As examples of current application of these map products, the Bureau of Land Management is using intermediate-scale maps as a base for plotting surface and subsurface ownership of mineral lands, and the U.S.G.S. is assessing petroleum resources in wilderness areas in western States and Alaska through the use of special map products. The introduction of digitized cartographic information is assisting Federal agencies in solving complex natural resource management problems through computer analysis. U.S.G.S. is producing digital cartographic data of elevation and of public land net, bounderies, hydrography and transportation. Other agencies are producing digital inventories keyed to the U.S.G.S. quadrangle maps. Different data sets can then be compared and evaluated rapidly by computer.

- The Satellite Imagery Program of the Department of the Interior is directly supportive of the subject act. This program, coordinated by the U.S.G.S., has been responsible for the improved reproduction and dissemination of satellite data in the form of image map products and earth science information systems. For example, the U.S.G.S. is preparing 25 Landsat image maps of northern Alaska for the Minerals Management Service to aid in their management and assessment responsibilities. The U.S.G.S. is also using satellite

imagery in conjunction with other earth science data sets in cooperative efforts with other Interior Bureaus and State agencies to assess mineral resource potential, and water and land use.

- The U.S.G.S Side-Looking Airborne Radar Program has already covered 150,000 square miles. During fiscal year 1983, the U.S.G.S. expects to award a contract for additional acquisitions totaling approximately 150,000 square miles, bringing the total public domain holdings to approximately 300,000 square miles. These data are expected to aid both public and private sector scientists in energy and mineral exploration. In addition, the U.S.G.S. is performing applications research using this technology to improve understanding of the uses of this tool.

- Massive polymetallic sulfide mineral deposts (primarily zinc, copper, and silver) and associated hot water springs have been discovered by U.S.G.S. scientists in August 1981, along the Juan de Fuca Ridge about 275 nautical miles off the coast of Oregon. Similar deposits have been found recently on the East Pacific Rise off Mexico, Central and South America.

- A significant new potential source of cobalt has been identified in cobalt-rich ferromanganese crusts of the

Mid-Pacific Seamount and Line Islands area of the central Pacific Ocean. Each of the many seamounts in the area is indicated in reports jointly released by the U.S.G.S. and German scientists to contain several millions of tons of ferromanganese crust having 1.0 percent or more of cobalt.

- The ability to discriminate subtle color differences in satellite imagery provides an important tool in locating certain types of ore deposits. Recent work has shown that many ore deposits have extensive surface halos of iron-stained ("limonitic") rocks associated with them that show up particularly well using multi-spectral satellite images. As a result, it is now feasible to augment exploration efforts with a new tool that provides highly useful data over vast areas at very low cost.

- Sophisticated chemical analyses of what were previously considered barren drill holes in central Missouri not only verify previously known lead-zinc mineralization in the area, but indicate that the belt of mineralization extends over a much greater area in Missouri. The geochemical method is particularly important in that all the ore bodies in the area are deeply buried and have no surface expression. Industry has already used the Geological Survey's data to locate and drill targets far to the west of known deposits.

- Water is a key factor in the development of the mineral resources of the Nation to support mineral extraction and processing and for water supply for industry workers and supporting service and commercial establishments. U.S.G.S. hydrologic investigations determine the recurrence, quantity, quality, and availability of the water in the area of mineral development for water supply purposes.

Some examples of specific materials research underway or recently completed in the Bureau of Mines include:

- Development of a selective ion exchange resin for recovering tungsten from brines. A large resource, estimated to contain 135 million pounds of dissolved tungsten, is contained in the brines of Searles Lake, California, part of the public domain.

- Technology has been devised to recover nickel and cobalt from low-grade Western laterites. The extractive metallurgical research, based on laboratory work, provided engineering data used by a Bureau contractor, UOP, Inc., in a 5 ton-per-day pilot plant. The pilot program demonstrated that the system was technically feasible.

- Chromium-free substitutes for 8600 and 4100 standard grades of heat treated constructional alloy steels which account for 10 percent of our annual consumption of chromium have been devised. Preliminary testing of experimental heats have yielded promising results with regard to microstructure, heat treat response and mechanical properties.

- A new concept for a duplex stainless steel containing 12- to 17-percent chromium with aluminum additions in the form of NiAl dispersions offers promise as a high performance alternative for grade 310 (25 percent chromium) stainless steel in high-sulfur environments.

- Domestically available resources, such as gibbsite, saprolite, corundum, and zunyite are being identified and tested as potential substitutes for refractory-grade bauxite. Other research indicates that properties such as slag resistance and hot strength of domestically available refractories can be improved through oxide impregnation. This technique holds promise for reducing the requirements for imported chromite and refactory-grade bauxite while maintaining performance.

- Research on recycling has focused on a variety of scrap and waste materials that contain large concentrations of

cobalt, nickel, chromium, and/or platinum-group metals. These include superalloy scrap, catalysts, spent stainless steel pickle liquors, and stainless steel and ferroalloy slags. Of major concern is the fact that over 20,000 tons, or 40 percent of domestic consumption, of valuable superalloys containing cobalt, nickel, and chromium are downgraded, exported, or discarded annually. Recycling of superalloy scrap is difficult because it is sufficiently contaminated to require refining or separation into pure metal. However, these alloys were designed to resist just the kinds of chemical dissolution techniques that are an integral part of conventional recycling processes. The Bureau is investigating two unconventional methods aimed at overcoming this resistance to chemical attack. One promising method involves the formation of intermetallic compounds which dissolve rapidly in acid solutions. The second method involves electro-refining of superalloy scrap to achieve separation and recovery of pure products.

- Work in another important area involves evaluation of a variety of acid and ammoniacal leaching procedures at high temperature and atmospheric pressures for recovering metals from spent catalysts. Initially, catalysts used by the petroleum refining and chemical industries were selected for study. Future efforts will focus on additional catalysts

as part of an evaluation of precipitation, ion exchange, and solvent extraction techniques for recovery of the metals from solution.

- And, while phosphate is not on the stockpile list, adequate supplies of fertilizers are essential to the U.S. and its allies. The Bureau introduced an improved phosphate recovery technique for western resources that could extend the life of Western U.S. phosphate reserves. A 100 ton-per-hour flotation unit, based on Bureau technology, will be operated this year by J. R. Simplot Company at Conda, Idaho. The company expects to increase the amount of phosphate derived from each ton of ore by 13 percent. The increased recovery rate, in turn, will aid in the reduction of mine production by 16 percent without cutting phosphate output. The process is applicable to much of the phosphate in the Western United States.

- The above examples deal with specific materials. In addition to such metallurgical and ceramic research, Bureau of Mines mining research developed improved mining methods applicable to many diverse mineral materials. Recent projects include: borehole mining, retractable diamond drill bits, movable in-pit crushers, and compact underground load-haul systems, in addition to long-continuing research intended to improve health and safety in mines.

A recent development that I am sure you will find interesting is our establishment of generic research centers intended to focus research in academia, government, and industry on specific areas of broad application in the mineral sector of the economy. These centers, managed for the Secretary of the Interior by the Bureau of Mines are currently funded for more than $1 million each and include:

Mine Systems Design and Ground Control--at Virginia Polytechnic Institute, with affiliates of Nevada, Alabama, Kentucky, Alaska, Idaho.

Comminution--at the University of Utah, with affiliates of Minnesota, Berkeley, Michigan, Colorado, and New Mexico.

Pyrometallurgy--at the University of Missouri at Rolla, with affiliate of Purdue in Illinois.

Mineral Industry Waste Treatment and Recovery--at University of Nevada, with affiliates Montana, Iowa, New Mexico, and Idaho.

A fifth generic center devoted to the engineering aspects of respirable dust--a problem in many mining, metallurgical, ceramic, and recycling operations, is currently being established. The generic centers should greatly facilitate concentration of effort, interchange of professors and graduate students, and assurance of our continuing to be in the forefront of mineral science and technology.

25-958 O—83——4

Your committee expressly inquired as to our policies for managing possible interruptions to supplies. As I indicated earlier in my statement, out basic policy is to rely to the maximum extent upon the market place for managing temporary displacements in peacetime, for we believe that the informed judgments of 233 million Americans acting to increase supplies, modify uses, and restrain panic demand are preferable to authoritarian bureaucrats using obsolete and incomplete econometric models to forecast the future. However, for defense emergencies, as distinct from peacetime perturbations, we have well established procedures in place as follows:

MATERIALS MANAGEMENT IN DEFENSE EMERGENCIES

Pursuant to Executive Orders 10480 and 11490 under the Defense Production Act, Federal Register Document 67-1313, and Executive Order 12155 under the Stock Piling Act, the Department of the Interior is responsible for emergency readiness plans and programs for all nonfuel raw minerals. As set forth in detail in FR 67-1313, the Department of the Interior is, in general, responsible for mines, concentrating plants, and refineries, and for the ores, concentrates, and other materials treated in such facilities. The Department of Commerce is responsible for facilities and materials that are further along in the chain of processing and utilization, and it maintains the Defense Materials and Defense Priorities Systems to channel materials to defense and defense-related production. Steel, copper, aluminum, and nickel have long been designated as "controlled materials" and they are the

basis for the systems through which the Department of Commerce channels materials to defense rated orders. The Department of the Interior has chartered the Emergency Minerals Administration to carry out actual operations in the event of a major emergency, and the Emergency Minerals Administration is based upon the Bureau of Mines, with support as needed from the U.S. Geological Survey and other Interior units. In emergencies, the Department of the Interior operates under the direction of FEMA.

The Bureau of Mines continuously monitors domestic production, imports, exports, stocks, and consumption of all major nonfuel minerals. Detailed reports are received monthly, quarterly, and/or annually from domestic mines, smelters, refineries, recyclers, and major users. Monthly import and export data are obtained from the U.S. Customs Service via the Bureau of the Census of the Deparment of Commerce. Bureau of Mines' experts continuously monitor developments in foreign supply areas. Every month the Bureau of Mines publishes for the guidance of government and industry its "Mineral Industry Surveys" which give up-to-date detailed statistics, and for several major important mineral materials monthly data are also summarized in the Bureau's "Minerals and Materials." A detailed review of U.S. and world production for more than 100 commodities is provided in the annual "Mineral Commodity Summaries," and special mineral commodity profiles giving details of world production, technology, reserves, resources, and outlook to the year 2000 are published as appropriate. As a result of its continual monitoring of mineral supply/demand and its technological

competence, the Bureau of Mines has the framework needed to discharge priorities, allocations, and supply expansion responsibilities. The Bureau would also act as the claimant agency for the mineral sector of the economy to assure needed fuel, power, transportation, personnel, supplies, and equipment. To facilitate coordinated government action in the event of an emergency, the Bureau in 1975 organized nearly 100 interagency mineral commodity committees. These committees include experts from the Bureau of Mines, the U.S. Geological Survey, and one or more areas of State, Commerce, Defense, CIA, GSA, Treasury, U.S. Trade Representative, Council of Economic Advisors, International Trade Commission, Commodity Futures Trading Commission, FEMA, DOE, and for certain commodities, Agriculture and Transportation. These committee's would be promptly called upon in the event of any emergency.

In the event of a supply disruption, the first action to be taken would be to monitor exports, followed, if necessary, by export controls. The Export Administration Act of 1979 authorizes use of export controls to restrict exports detrimental to U.S. national security, to further U.S. foreign policy, or to protect the domestic economy from the excessive drain of scarce materials and to reduce the serious inflationary impact of foreign demand. The Secretary of Commerce is charged with monitoring exports and contracts for exports, of any nonagricultural good "when the volume of such exports in relation to domestic supply contributes, or may contribute, to an increase in domestic prices or a domestic shortage, and such price increase or

shortage has or may have, a serious adverse impact on the economy or any sector thereof."

A worsening supply situation would require imposition of a system of priorities, under Title I of the DPAct, whereby rated orders would have to be filled first. If priorities proved to be inadequate, they would be followed by a system of allocations, also authorized by Title I. The Bureau of Mines and the Department of Commerce would implement priorities and allocations in their respective areas of responsibility.

At some point in a serious shortage situation recourse to the strategic stockpile might be required. The Stock Piling Act provides for release "(1) on the order of the President, at any time the President determines the release of such materials is required for purposes of the national defense; and (2) in time of war declared by the Congress or during a national emergency, on the order of any officer or employee of the United States designated by the President to have authority to issue disposal orders...if...required for purposes of the national defense." To release stockpiled materials, FEMA, in consultation with other agencies including the Bureau of Mines, would prepare a justification and recommendation for the President's signature. On receipt of the President's authorization, the Office of Stockpile Disposal of GSA would release the material to specified recipients.

Export controls, priorities and allocations, and stockpile releases, however, are only temporary measures of limited effectiveness.

Any long-lasting supply disruption would call for supply expansion programs under Title III of the DPAct. These would cover not only domestic deposits but also deposits in reliable foreign sources. The Bureau of Mines would recommend needed mineral supply expansion programs to FEMA, which would then direct GSA to make the necessary contractual arrangements.

That completes my formal statement and we are ready to reply to your questions.

Mr. GLICKMAN. We thank you very much for your statement.

I would make a couple of points. No. 1, I think your point number one on page 1 is an excellent statement of the issues involved here, the interrelationships between materials policy, minerals policy and broader industrial policy. I think you have stated it as well as I have seen it stated anywhere.

However, I do think that your second statement deserves a little further amplification. I think it is somewhat anomalous that, as the Nation's domestic minerals processing capacity continues to deteriorate under pressure of subsidized foreign sources, that the administration expects such market forces, the free market, to totally fulfill our economic and national security needs, which is implied in you statement. On the contrary, it seems to me the international market forces are incapable, at least exclusively, of stimulating domestic industries against subsidized foreign suppliers. Market forces and national priorities do not always coincide. Our ferroalloys smelters, for example, are now virtually extinct, as my colleague from Colorado talked about, given today's market forces.

My point would be that as the marketplace doesn't necessarily work very well when you have the Japanese Government involved doing heavy subsidization—and they are not going to give that up. Are there not circumstances where a secure source may be more valuable than an insecure though less expensive source? I am challenging, I guess, the basic premise of your second point.

Dr. MILLER. Your point is well taken, sir. Our point would be pretty much the same. Certainly there are circumstances under which cooperative research and development efforts on the part of Government and industry are an absolute necessity in this country. Our point would simply be that we minimize the rule of Government, insofar as possible. We would far rather see that handled by the private sector.

Mr. GLICKMAN. For example, we all talk about free trade. Recently, the President imposed a tariff to protect the last domestic motorcycle manufacturer in the United States, which again shows you that there is at least some element of pragmatism at all levels of Government. What you are telling me now is that you feel that way yourself as well.

On page 7 of your testimony, you talk about that the U.S. Geological Survey is producing digital cartographic data of elevation and of public land net boundaries, hydrography and transportation. Are there public lands that have economic deposits of critical and strategic minerals?

Dr. MILLER. Yes, sir.

Mr. GLICKMAN. There are.

Dr. MILLER. Certainly.

Mr. GLICKMAN. Do you catalog those for the purpose of the public?

Dr. MILLER. Yes, sir, for a long period of time. We have been cataloging them, and we will continue to catalog them in the future.

Mr. GLICKMAN. What is holding back their development?

Dr. MILLER. A great maze of regulatory problems.

Mr. GLICKMAN. I am talking about economic deposits of critical and strategic materials.

Dr. MILLER. Keep in mind, sir, before you can know there is an economic deposit there, a great deal of work has to be done. Up until now, much of that work has been prohibited, so we are unable to say, in answer to your question——

Mr. GLICKMAN. Let's talk about chromium. Do we have competitive deposits of chromium, let's say, to South Africa? Do we have any chromium in the United States to speak of?

Dr. MILLER. Yes, sir.

If I may, let me use that as an example, because that is one of the best understood of all. And I will turn to Dr. John Morgan here who has had many years of experience on that very subject. There is a misunderstanding in the country about chromium, simply because it has received more acclaim, I guess, then other minerals.

Mr. GLICKMAN. OK. Dr. Morgan.

Dr. MORGAN. Mr. Chairman, thank you very much for asking that leading question.

Mr. GLICKMAN. I hope you are not going to read that entire computer printout, Dr. Morgan.

Dr. MORGAN. What we have here is a computer printout of every known chromium deposit in the country. As you can see, it goes on page after page after page. That is just the index to our computerized Minerals Availability System [MAS] in the Bureau of Mines and the Computerized Resource Information Base [CRIB] in the Geological Survey.

Mr. GLICKMAN. By the way, are these, to the best of your knowledge, commercial deposits of chromium or is it a little matter of chromium here and there in molecular amounts?

Dr. MORGAN. These range from the one extreme to the other. Some of these are locations where somebody found one little rock with chromium sticking out on the surface, and on the other hand are mines that have produced in World War I, in World War II, and the Korean War period, and every category in between. Behind every single line on this computer printout, we have files in the Bureau of Mines and the Geological Survey going into the details that are known about each one.

Let me say that, at the present time, there are no economic commercial chromium operations in this country. We do know, howev-

er, that out in the Stillwater complex of Montana, they did produce 900,000 tons of 38 percent Cr_2O_3 under a Defense Production Act contract for $36 a ton running from about 1951 until 1960. We do know that there are small deposits in California and Oregon and elsewhere which were producers in World War I, World War II and the Korean war.

In fact, sir, chromium has been on strategic minerals lists ever since World War I. I can cite a 1921 report by the Director of the Geological Survey and the Director of the Bureau of Mines and the personal advisor to the President at the Versailles Peace Conference which lists chromium right up at the top of the list.

Mr. GLICKMAN. I guess my point is that Dr. Miller and you have touched on this area that I have yet to see what I call a factually accurate objective statement of economic deposits and critical and strategic minerals. I don't think it is necessarily worth going in great detail on this point, but to those people who tell me that they are all in Third World countries—there seems to be a large number of people in the Defense Department and in FEMA who say that. Are you saying they are wrong?

Dr. MORGAN. The economic deposits of chromium are in South Africa, Zimbabwe, Turkey, and the Philippines, and in a number of other scattered countries around the world. There is also chromium in the Soviet Union. The major profitable deposits in the free world are in South Africa.

Mr. GLICKMAN. Let me just stop you there. I think my point is that, sure, I think your computer printout is interesting, but I guess the point is that in broad policy decisions, you have to make judgments on the issues of materials and minerals, as you talk about. At some point, mining chromium with a rock here and a rock there is less productive than finding a materials substitute for that mineral in terms of large aggregate policy. That is what this Cabinet Council is supposed to do, to deal with the broader issues. I guess the function of the hearing today is to try to determine some of the answers to that.

Let me ask you this question. My understanding is that your department chairs, basically, the Cabinet Council—the Secretary of the Interior is the Chair. Neither the Department of Defense nor the Department of Commerce are represented directly on the Cabinet Council. Should that be corrected, given the Department of Defense's needs in the areas of materials processing, advanced materials, et cetera, and given the fact the GAO testified that the subcabinet group involving DOD and the Department of Commerce no longer meets?

Dr. MILLER. Again, let me turn to Dr. Morgan because he has detail that will show how we do work with that group.

Mr. GLICKMAN. OK.

Dr. MORGAN. Sir, I think you will hear a little later from Mr. Robert Wilson of the Commerce Department—and I know that he works very closely with Mr. W. Perry Pendley, the Deputy Secretary of Interior under Secretary Miller's jurisdiction on these matters. I know that, if for no other reason that he is on the telephone to me every couple of weeks wanting things in addition to what he wants from Mr. Pendley. By the same token, Mr. Donnelly of the Defense Department and I are back and forth every couple of days

on such issues as the stockpile, research and development in the Pentagon, title III of the Defense Production Act, and title I of the Defense Production Act.

Our working is actually better on an informal, person-to-person basis than elaborate structured arrangements that have existed in the past. We have confidence in one another. We are generally professionally qualified. If I may say so, we have survived a number of administrations and continue working together. Top level people come and go, but at the working level, cooperation goes on all of the time. I don't think there is a problem.

Mr. GLICKMAN. So you would disagree, then, with the GAO's interpretation.

Dr. MORGAN. Certainly.

Mr. GLICKMAN. My final question is that it seems to me that with the Secretary of Interior being the chair of this group, that there is going to be a public lands and minerals focus to the issue of materials. I guess my concern is that, as your number one statement, that if that is in fact the focus, we may be missing the boat in terms of relating minerals and materials to a national public policy. There are lots of other components to it, and I fear that not having a DOD formal component or a Commerce Department formal component, even accentuates your focus on minerals issues which may not be a major part of the bigger issue.

That is just a statement.

Mr. McCandless.

Mr. MCCANDLESS. Thank you, Mr. Chairman.

I don't want to over do this, but I would like to go back to the chromium discussion. I am going to make a certain assumption, and you tell me whether I am right or wrong. We get our chromium from Zimbabwe because we get it cheaper, because the quality of the ore is much higher and, therefore, economically speaking, it is more desirable; is that a fair statement?

Dr. MORGAN. From Zimbabwe, and more so from South Africa, and actually, sir, we import most of it now in the form of ferrochromium which is a semimanufactured form once removed from the ore.

Let me say that chromium is one of the cheapest materials in the world. Ferrochromium costs about 35 cents a pound which compares to ferrosilicon, and silicon is one of the most abundant elements in the Earth's crust. The reason that we use a lot of chromium is that it is cheap.

I would also like to point out that our strategic stockpile is 98 percent on hand in terms of chromium units. There is a current effort to upgrade some of the chrome ore to the ferrochrome form because of the decline of the ferroalloy industry, as has been alluded to. The President has directed a stockpile upgrading program to help alleviate that situation.

Mr. MCCANDLESS. Without going into a lot of detail, if push comes to shove, we have resources within the United States that could supplement or replace those we are importing if we were not primarily interested in the economic aspect of it?

Dr. MORGAN. That is right, sir. At a guaranteed price of two or three times the current price, if that price were maintained, we could produce a fair amount of chromium in this country.

Mr. McCANDLESS. I was interested in a comment made by the previous person about the CCNRE and FEMA. I wonder, Mr. Miller, if you could tell me how they interface from your perspective or point of view since Mr. Watt is the chair for the CCNRE?

Dr. MILLER. Again, sir, I would have to turn to Dr. Morgan for a better explanation.

Mr. McCANDLESS. Whomever we get the explanation from is fine.

Dr. MORGAN. We are doing much of the day-to-day work, sir.

The Federal Emergency Management Agency, FEMA, has a group which is, rather oddly, called the Annual Materials Plan Steering Committee. Actually, it meets once a month, or even more often if there is a need for so doing, and it includes all of the agencies that are concerned with strategic materials—not just minerals, but materials—Defense Department, Mr. Donnelly who is here this morning is on the committee; I am on there representing Interior; Commerce has a number of people; State; CIA; Treasury; OMB; Energy; Agriculture; and GSA; and others as appropriate.

This committee meets frequently and has various subcommittees. We have created 100 subcommittees, 1 for each material. They don't meet all of the time. They only meet when there is a problem. But in 16 different agencies, we have designated people to serve on commodity subcommittees. These are kept up to date. I can provide a copy of the roster for the record here.

The only time that we bother the Cabinet Council is if there is some issue that cannot be resolved at these lower levels. Then we would escalate it from the Annual Materials Plan Steering Committee, probably up to the Emergency Mobilization Preparedness Board, which is chaired by Judge Clark, the President's National Security Advisor, and on which our Under Secretary sits as a member of the Board along with the Under Secretaries of other agencies. If this still was an irreconcilable matter, it would be referred up to the Cabinet Council. Meanwhile, as the Secretary indicated here, the Cabinet Council works from the top down. They handle issues like public lands policy, what to do about the Law of the Sea, what about the Exclusive Economic Zone, et cetera, which apply to all materials. So the system works fairly well.

Mr. McCANDLESS. Mr. Miller or whomever you may wish to designate this one more question to, with reference to Public Law 96-479, from your point of view, are you satisfied that the intent of this law is being carried out in a satisfactory manner?

Dr. MILLER. Yes, sir, I am.

I think there is something that needs saying that we often lose sight of. But ever since World War I, when our Nation came to understand the need for minerals and materials, and since the role that was played by the Bureau of Mines during times of emergency such as World War II and other hostile times that our Nation has passed through, we have come to understand how necessary these things are. It is not necesssarily the policy that makes any difference, it is whether or not you get the job done when you need to get the job done.

President Eisenhower was one of the foremost leaders in this particular phase of our history, making it very clear that minerals policy was important to this Nation. President Reagan now has restated that same thing. The policy is not that easy to lay in front of

a group or of a committee and say, "This shall be our policy." The thing that counts is what Dr. Morgan is referring to, the active, day-to-day working relationship that gives our Nation the security that it needs to handle any of these emergencies.

Mr. McCANDLESS. Thank you, gentlemen.

Thank you, Mr. Chairman.

Mr. GLICKMAN. Before I yield, Mr. Miller, the statute requires an annual materials assessment, and we haven't had one. Why? It would seem that you would need the assessment to do the job.

Dr. MILLER. I would have to say, Mr. Chairman, we have been attempting to make an assessment of the minerals and materials of this Nation ever since we first settled the country, and we will continue to do that right along. It isn't something that we can just do in a very short time.

Mr. GLICKMAN. The statute is fairly clear, is it not? I think that the statute requires that an annual assessment of materials needs, R&D related and other kinds of things, and we haven't had one. What concerns me about that is that I am not sure if the issues are all that complicated or if the problem areas are all that complicated. I think you, stated that. It would seem to me that that would be a very important thing for the long-term national security and industrial policies, to know what our problem areas are. Congress asked this Council to do it and we haven't gotten it yet. I thought I would make that point again.

Mr. Kogovsek.

Mr. KOGOVSEK. Thank you, Mr. Chairman.

Following up on that subject, materials policy is just one concern of the Cabinet Council, Mr. Miller, on Natural Resources and the Environment. How often does materials come up in the Cabinet Council discussions?

Dr. MILLER. I can't answer that question, sir. I am not really privy to that information. I am not that familiar with it.

Mr. KOGOVSEK. OK. Can you tell me how that Cabinet Council responds or should have responded to the announcements in West Germany, France, and especially Japan of government-sponsored and directed research thrust in advanced material technologies. It seems to me from your testimony that minerals availability is overemphasized, while materials and R&D and others are ignored. Who is thinking about the materials side?

Dr. MILLER. Most certainly, the Bureau of Mines has been involved with materials research ever since its inception. Other than that, I am not sure that the Department of Interior has that responsibility.

Mr. KOGOVSEK. Let me ask you if you know the answer to this question. What effort has the Cabinet Council made to solicit advice from industry concerning national materials research and development needs?

Dr. MILLER. I can't answer that either, sir.

Mr. KOGOVSEK. You can't answer how industry communicates with the Cabinet Council or with COMAT?

Dr. MILLER. No, sir. I don't have any special knowledge of how they do this or when or why or what.

Mr. KOGOVSEK. I think you are aware, Mr. Miller, of my concern that there isn't proper coordination. I become more concerned

when I listen to Dr. Morgan say that the system works fairly well. He indicates that the only time you bother the Cabinet Council is when—that word "bother," because I don't think the Cabinet Council should be bothered—the only time you bother the Cabinet Council is when something can't be rectified at a lower level decision-making basis. It seems to me that gap causes me problems, because I think that Cabinet Council should know what is going on. I don't think that is happening.

Dr. MILLER. May I, sir, turn to Dr. Morgan again for just a moment and have him very briefly tell you about the flow of information that does go on on a weekly, monthly, quarterly basis, and what have you.

Mr. KOGOVSEK. Briefly.

Dr. MORGAN. Let me say, sir, there are a number of mechanisms in the Government whereby these things are brought to the attention of higher-level people. Certainly the annual budget process that Dr. Keyworth alluded to here earlier this morning is the prime mechanism in which the Government coordinates what it is doing.

We surface these areas and issues up to Secretary Watt in the budget process. The stockpile issues are escalated up to General Guiffrida and Judge Clark in the budget process dealing with the stockpile. The contact with industry goes on every day.

Mr. KOGOVSEK. Let me interrupt you, if I could, Dr. Morgan, because I think it is important that we get down to at least one person in my mind.

Who, if any one person, is considering a particular minerals or materials location, extraction, processing and consuption system, and developing a systematic approach to resolve potential U.S. vulnerability in a particular market? I don't want to know the whole process, I just want to know——

Dr. MORGAN. The U.S. Bureau of Mines is doing that for every one of the 80 mineral materials that are strategic and critical under the Stock Piling law, and it is also doing it for many materials that are not designated as strategic and critical. We are doing it for phosphates, for potash, for iron ore, for limestone, for every material that is of mineral origin.

If you would come down, sir or if we could come up to you and show you what we have in our files, going back 100 years, that Secretary Miller alluded to. This isn't a new question.

Mr. KOGOVSEK. Let me ask you another question, Mr. Miller or Dr. Morgan. Quality, quantity, and physical and chemical environments of resource occurrences must be estimated in order to determine the viability of a mineral resource. It is my understanding that the Department of Interior's assessments rate minerals as having low, medium, or high potential.

How detailed is your data on which you base a low, medium or high potential?

Dr. MILLER. Let me try to work with both gentlemen, because both the USGS and the Bureau of Mines do assessment work. That is the term we would use for that type of thing.

Dr. Morgan.

Dr. MORGAN. The fundamental way of assessing the resources in this country has been through the private sector. That is why we

have the Mining Law of 1872 which set forth the method of obtaining title to a mineral deposit on public lands. It is impossible for bureaucrats to comb the surface, look at a few rocks on the surface, make a few chemical tests, and decide what lies 2 to 5 miles below. Some of the deepest mines in the world are over 2 miles deep, some of the oil wells are 5 or 6 miles deep, and until you put a hole down there and find out what is there, there can be no definitive assessment of the mineral resources in what is below.

We in the Bureau of Mines and the Survey attempt—and I think our Survey colleague will say more of the work that goes before—but what we do in the Bureau of Mines is to look at records that have existed before and we take some samples on the surface. But it would cost billions and billions of dollars to drill holes in public lands to really find out what is there. We could make the West look like swiss cheese if we had the money, but unless you put a hole down, you don't know what is there.

Let the Survey man respond further to that.

Dr. MILLER. Dr. Prinz.

Dr. PRINZ. The question of high, low or intermediate potential is applied on an area basis. A particular area or a particular tract of ground is considered to have either a high potential for the occurrence of a deposit of a particular commodity or a low potential. It is the same sort of an assessment and evaluation that a mining company would go through in deciding whether to drill here or there.

The assessment is based on the available knowledge of the geology of that particular area, the analysis of geochemical samples from that particular area, geophysical data, and, as Dr. Morgan pointed out, on the known mineral occurrences in that area.

Mr. KOGOVSEK. It seems to me, Mr. Chairman, that I am still not, in my own mind, getting the kind of answer to a very important question. I would ask it again of Mr. Miller or Dr. Morgan or whoever. Who really determines the responsibility for any given program or policy initiative? That is the basic question, I think.

The mining industry is going to heck in a handbasket, whether it is copper or whatever. The industry is dying. Who is responsible. Who is the one person we go to? I haven't heard that answer today, and I haven't heard it last week or whatever. That is why I still think, in spite of what Mr. Miller and the Department of Interior says, that everything is fine and we have nothing to worry about and everything is being taken care of, I don't see the answer to that one question. Who is responsible?

Dr. MILLER. I don't think there is an answer to the question, sir.

Mr. KOGOVSEK. There should be an answer. I guess that is what this hearing is all about.

That is all I have, Mr. Chairman.

Mr. GLICKMAN. Thank you.

I would like to ask one question. The statute, Public Law 96-479, has the following: "The Secretary of the Interior shall promptly initiate actions to improve the capacity of the Bureau of Mines to assess national minerals supplies, increase the level of mining and metallurgical research by the Bureau of Mines in critical and strategic minerals and improve the availability and analysis of mineral data in Federal land use decisionmaking. A report summarizing ac-

tions taken required by the subsection shall be made available to Congress within 1 year after enactment of this act."

Have you provided that report to Congress?

Dr. MILLER. I would say that we have.

Again, let me turn to Dr. Morgan for an update on the schedule and status of these reports.

Mr. GLICKMAN. OK. That is the only report that Interior is required to give. Do we have the report yet?

Dr. MORGAN. Sir, I do not know if a specific report aimed at that particular subtitle of the act has been submitted or not. That, I do not know.

I can assure you that all of the work that is described there is going on in the Bureau of Mines.

Mr. GLICKMAN. I have got to tell you, we have heard from Dr. Keyworth and he hasn't done his assessment; I have heard from the Secretary of Interior now, and it doesn't look like we have got the report that is required under the statute. I think that the Commerce Department is the only Department that has actually complied with the statute. This statute has been basically ignored since it has been created. This administration has gone its merry way—I am not just blaming the administration because it may be policies previous to this administration—but Congress said in this statute that we have a problem with materials policy, the rest of the world is overtaking us, and we have to come up with some kind of cohesive plan.

I appreciate your testimony today, but it really troubles me that we have got at least two agencies, and maybe three in Government who have basically not complied with the statute. I think that is why the GAO came down the way they did. After all, they are supposed to be our watchdogs. If you have done your work as required under the statute, we should have had the report within one year and, if we didn't have that report, we should have found out why. As I said, it looks to me as if the Commerce Department is the only one that said it was serious. The reason why they said it was serious, I venture to say, is because they are working with the real world and industry, and they need materials to go in airplanes and cars and exotic materials, microcomputers and everything else.

If the report is here, I apologize. But if the report is not here, I would urge you to get it to us just as quickly as possible to comply with the statute.

Dr. MILLER. We certainly will, sir.

Mr. GLICKMAN. Thank you very much for your testimony.

Our next witness is Richard Donnelly, Director, Industrial Resources for the Office of the Deputy Under Secretary of Research and Engineering at the Department of Defense.

Mr. Donnelly, it is a pleasure to have you here. As I have indicated to the previous witnesses, you may feel free to summarize. Your statement is fairly short. We have to break for a vote around 12:05, but we will come back and finish this morning in the event that that happens.

STATEMENT OF RICHARD DONNELLY, DIRECTOR, INDUSTRIAL RESOURCES, OFFICE OF THE DEPUTY UNDER SECRETARY FOR RESEARCH AND ENGINEERING, U.S. DEPARTMENT OF DEFENSE, ACCOMPANIED BY MAJ. JOHN BRELAND, DIRECTOR, MATERIALS R&D, DEPARTMENT OF DEFENSE; AND KENNETH FOSTER, STAFF DIRECTOR FOR MATERIALS POLICY, OFFICE OF THE DEPUTY UNDER SECRETARY FOR RESEARCH AND ENGINEERING, U.S. DEPARTMENT OF DEFENSE

Mr. DONNELLY. In the interest of time, let me try to summarize the prepared statement.

Before beginning, let me introduce on my left, Major John Breland, U.S. Air Force, who is responsible for materials R&D efforts within the Department of Defense; and on my right, Mr. Kenneth Foster from my office, who is the Staff Director for Materials Policy.

Let me try to summarize as quickly as I can the prepared statement.

We are continuing our participation with other Federal agencies which are assessing national materials problems, and we are pursuing necessary independent activities resulting in actions to fulfill the spirit of Public Law 96-479. I would like to address only those actions relating to Department of Defense mission responsibilities.

We have secured the continuing support of the Institute for Defense Analysis to assist us in assessing the overall problem of specific materials, minerals and R&D policy option impact appraisals for our review. This continuing effort includes careful analysis of materials technology and production options available to the Department of Defense to improve the supply and production aspects involving domestic industries.

The initial broad overview appraisal studied the use of and the availability of titanium, beryllium, chromium, cobalt, tantalum, carbon fiber, and quartz as applied to the production of military weapon systems. Our subsequent effort, now nearing completion, is focusing on military needs for materials technology options for titanium, organic, carbon-carbon, and metal matrix composites, gallium and germanium.

At this point, we have funded over $1 million in comprehensive assessment efforts to meet the continuing requirements of Public Law 96-479 with the intent, not only of reporting, but to make effective practical application of our assessments.

As a part of the DOD effort in the R&D area, the Military Departments' Directors of Laboratories have recently established an Advanced Materials Panel, one task of which is to conduct a triservice, Army, Navy, Air Force, study on critical materials. This group has as its objectives, No. 1, evaluation of the impact of critical materials and shortages thereof on future DOD systems; No. 2, exploration and definition of needs for coordinated or interdependent triservice R&D programs; No. 3, proposals for strategies to hedge against future shortages of critical materials; and No. 4, identification of roadblocks to success.

We have also found that the Defense Production Act and the Strategic and Critical Materials Stockpiling Act are both fundamentally sound. The administration has taken actions to improve

implementation of both acts. The DOD is well into the beginning phase of taking a fresh look at the need for using the Defense Production Act Title III authorities to insure the viability of the defense industrial base so that DOD's 5-year plan can be carried out effectively and efficiently. This will also improve preparedness.

In this respect, the fiscal year 1984 DOD budget request includes $200 million for establishment or expansion of needed production capacities which we believe is an appropriate funding level. Our objective is to establish an effective, efficient, and credible program for the development of domestic production capabilities in those areas where the free market cannot respond in time to meet our needs, particularly when we are unacceptably dependent on unstable foreign sources for supply. We plan to use only purchase commitments under title III to avoid any undue disruption to the credit market and to insure that the full costs of a project are taken into account before beginning.

For definition purchases, a purchase commitment is a supply contract to buy a set amount of products critical to the national defense at a negotiated price over a set period of time.

Mr. Chairman, with these considerations, the Department of Defense has moved out prudently in proposing practical implementation of the information derived from the Public Law 96-479 data-gathering and assessment efforts with a comprehensive management plan.

This concludes my statement, and I will be pleased to respond to any questions the subcommittee may have.

[The prepared statement of Mr. Donnelly follows:]

Hold Until Released
by the Committee

STATEMENT BY

MR. RICHARD E. DONNELLY
DIRECTOR, INDUSTRIAL RESOURCES
OFFICE OF THE UNDER SECRETARY OF DEFENSE
FOR
RESEARCH AND ENGINEERING

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
OF THE
COMMITTEE ON SCIENCE AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

17 MAY 1983

Hold Until Released
by the Committee

25-958 O—83——5

Mr. Chairman and members of the Subcommittee I appreciate this opportunity to appear before you today to discuss the status of actions required of the Department of Defense (DoD) under the National Materials and Minerals Policy, Research and Development Act of 1980, Public Law (P.L.) 96-479.

On April 5, 1982, the President issued his National Materials and Minerals Program Plan and Report to Congress in response to P.L. 96-479; his position is that national materials policy will be coordinated through the Cabinet Council on Natural Resources and Environment. In addition, the DoD is continuing its participation with other federal agencies which are assessing national materials problems and is also pursuing necessary independent activities resulting in substantive actions to fulfill the spirit of P.L. 96-479.

While the President's National Materials and Minerals Program Plan and Report to Congress addresses a broad spectrum of federal agency responsibilities, I will address only those relating to DoD mission responsibilities.

Before proceeding, however, let me review the perspective with which the DoD approached the findings, policy, and requirements of P.L. 96-479 and the derivation of problem-solving techniques intended to result in cost-effective and meaningful material management decisions necessary to support the national security. Upon enactment of P.L. 96-479, we were fully aware that a full and complete response to all the problems outlined could be a long-term, continuing, and expensive effort since basic and exotic material problems have existed since the nation's inception and have become particularly unique in advanced weapon system technologies. World War II experience highlighted the breadth of this extensive issue and the Congress, in its wisdom, passed the Defense Production Act of 1950 and the Strategic and Critical Materials Stockpiling Act to provide the legislative

basis for a number of industrial preparedness programs essential to the national security. With this important background in mind, the DoD developed a management plan in response to P.L. 96-479 to assess broad and specific materials and processing capabilities; we also developed a DoD-wide research and development plan; and we developed an updated foundation for prudent use of Title III of the Defense Production Act. In addition, we assessed the legislation identified.

We secured the continuing support of the Institute for Defense Analysis to assist us in assessing the overall problem with specific materials, minerals, and R&D policy option impact appraisals for our review. This continuing effort includes careful analysis of materials technology and production options available to the DoD to improve supply and production aspects involving domestic industries. The initial broad overview appraisal studied the use and availability of titanium, beryllium, chromium, cobalt, tantalum, carbon fiber, and quartz as applied to production of military weapon systems. Our subsequent effort, now nearing completion, is focusing on military needs for materials technology options for titanium, organic, carbon-carbon, and metal matrix composites, gallium and germanium. Our most recent effort, which is in the data gathering phase, includes an overview of military needs in the advanced composites area including major producers and fabricators of world-wide (non-Bloc) producers, pricing aspects and trends plus an evaluation of the supply/demand picture for military laser materials, as projected over the next five years. In short, we are covering military aspects of both basic industry and high-technology materials arenas to determine the extent of our import dependencies, stable sources of supply, and domestic industrial capability needs. At this point, the DoD has funded over $1 million in comprehensive assessments efforts to meet the continuing requirements of P.L. 96-479 with the intent, not only of reporting, but to make effective practical application of our assessments.

The bulk of DoD research and development is spent on developing weapons systems to meet specific military requirements. DoD is also concerned with conservation, substitution, and replacement of critical materials when this motivation aligns itself with fulfilling military requirements. Materials R&D develops new classes of materials and new processing techniques to improve military systems performance and create new military capabilities. Opportunities for more efficient use or replacement of critical materials are investigated if aligned with military requirements. As a part of the DoD effort in this area, the Military Departments' Directors of Laboratories have recently established an Advanced Materials Panel, one task of which is to conduct a tri-Service study on critical materials. This group has as its objectives:

1. Evaluation of the impact of critical materials, and shortages thereof, on future DoD systems;

2. Exploration and definition of needs for coordinated or interdependent tri-Service R&D programs;

3. Proposals for strategies to hedge against future shortages of critical materials; and

4. Identification of roadblocks to success, including the potential problems of technology gaps, shortages of personnel, and funding deficiencies.

A major portion of the ongoing military performance-oriented materials and structures R&D program has been planned to strongly consider the direct substitution option while still fulfilling our mission needs. For example, our vast R&D composites program, consisting of organic, metal, and carbon matrix composites, will develop direct substitutes and production decision options for several critical and strategic materials. Furthermore, a substantial portion of the DoD rapid solidification technology program will be developing superalloy and other materials which will use lower fractions of strategic elements and display appreciable performance benefits. Overall, about 30 percent of our total

ongoing materials and structures R&D program will be developing new materials which have significant potential, in an emergency situation, to be used as substitutes for certain critical and stragegic materials in the production of essential weapon systems.

For example, the FY 1982 DoD Appropriations bill included $1 million for additional R&D in metal-matrix and carbon-carbon composite materials to address the substitutes option for specific military applications within the Navy's $33 million materials technology program. Overall, we must emphasize that military R&D is directed at improving materials with important military applications. This is the result of DoD's goals to pursue mission objectives such as improved submarine depths, tank armor, satellite survivability, targeting efficiencies, flight speed, manueverability and whatever high performance is required to ensure superiority in battle. Our R&D funding is designed to establish or maintain the technological advantage needed.

We have also reported that the Defense Production Act and the Strategic Critical Materials Stockpiling Act are both fundamentally sound. The Administration has undertaken actions to improve implementation of both acts. The DoD is well into the beginning phase of taking a fresh look at the need for using Defense Production Act Title III authorities to ensure the viability of the defense industrial base so that DoD's five-year plan can be carried out effectively and efficiently. This will also improve preparedness. In this respect, the FY 1984 DoD budget request includes $200 million for establishment or expansion of needed production capacities which we believe is an appropriate funding level. Our objective is to establish an effective, efficient, and credible program for development of domestic production capabilities in those cases where the free market can not respond in time to meet our needs, particularly when we are unacceptablely dependent on unstable foreign sources for supply.

We plan to use only purchase commitments under Title III to avoid any undue disruption to the credit market and to ensure that the full costs of a project are taken into account. For definition purposes, a purchase commitment is a supply contract to buy a set amount of products critical to the national defense at a negotiated price over a set period of time.

With these considerations, the DoD has moved out prudently in proposing practical implementation of the information derived from the P.L. 96-479 data gathering and assessment efforts with a comprehensive management plan. Therefore, with our R&D and domestic industrial base responsibilities to support the national defense, the DoD expresses clear recognition of this fact with a positive step forward by requesting the required funding to support its responsibility.

This concludes my prepared statement. I will be pleased to respond to any questions the Subcommittee may have.

Mr. GLICKMAN. Thank you very much, Mr. Donnelly.

Mr. Donnelly, the law that we referred today requires that you shall prepare a report assessing critical materials needs and that report shall be made available to the Congress within 1 year after enactment of this statute and revised periodically.

I don't believe that, as of yet, the Congress has received the report. Could you give me a status report on that?

Mr. DONNELLY. Yes, sir, you are correct. I do not believe the Congress has received the report. It has been prepared and is presently under review within the administration. I hope we can get that to you as soon as possible.

Mr. GLICKMAN. Is it at OMB?

Mr. DONNELLY. It is at OMB presently, sir.

I might add gratuitously here that the report—which I think you will find very acceptable—really caused a process of inquiry in itself that created many of the recommendations that we are now trying to implement. So the fact that with the committee's usually gentle prodding that took place along this line, things have been accomplished. It is just that the written material is not yet in your possession.

Mr. GLICKMAN. The second question I would ask you is does the current approach to coordination of Federal materials R&D programs meet DOD needs? Specifically, since DOD is not directly represented on the Cabinet Council, are your interests being served?

Mr. DONNELLY. I believe so, Mr. Chairman. While we are not a statutory member of the Cabinet Council, we do provide representation to its meetings when it is appropriate and when there are appropriate defense issues. I, myself, have attended one of those meetings. I know that Dr. Fred Ikle, our Under Secretary of Defense for Policy, attends when appropriate.

I think, generally speaking, as Dr. Morgan pointed out earlier, there is a substantial amount of interagency coordination in the

materials area that goes on, in addition to Cabinet councils and legislation.

Mr. GLICKMAN. One of the criticisms I have heard, and it is a kind of institutional problem, is that your Department is so large with such a massive budget that you tend to go your own way anyway because you have national security needs. I found that, in some areas like in materials or in alternative energy activities, there are programs within the Department of Defense that I was not aware of before.

I guess one of my concerns is not only do you get the necessary research information for strategic purposes—such as finding alternatives to titanium or cobalt or chromium--but that these research results get out from you into the commercial sector of the economy. You are doing such a dramatic amount—you are talking about $200 million in one area alone. I don't know how much of that is totally in the materials area—but one of the things that clearly strikes me through all of the conversation today, and I am not advocating a planned economy, but there doesn't seem to be very much a sharing of information and transfer of such technology into the private sector. Whether that means we would have some sort of computer clearing house on materials needs or a national data bank or what it strikes me that you are probably doing more work than any of the other agencies are, although some of the other agencies are doing a lot of work, such as NASA. I am just wondering about ways that we can improve that flow in, as well as out.

Mr. DONNELLY. You touched on a very important subject. Let me try a couple of analogies here.

One of the other jobs that I have is worrying about the industrial base for the Defense Department. In reality, there is no captive or separate defense industrial base or defense materials network. In reality, we are dealing with the commercial marketplace. The DOD is another consumer in that marketplace. In many cases, we are a small taker of raw material, yet, those materials are vital to an economy that we need in peacetime and obviously in to the extent that the economy becomes unviable, then so does the acquisition of defense hardware from that economy and, therefore our interest in it.

Since there is no separate defense industrial base, we have to make the best use possible of that commercial sector. And we learned a long time ago that the more we can share with the commercial sector, what our needs are and successes are, the easier it makes for us to go about our business.

For example, on the needs side, over the past year, we have developed a defense economic impact modeling system which, said simply, takes the 5-year defense program or acquisition of weapons and equipment and breaks that down the four-digit SIC. This is another way of saying that, if we are spending a million dollars on a tactical missile program, we now can share with producers of aluminum castings, ferroalloys, semiconductors, what our demands over each of the next 5 fiscal years, with all of the caveats that Congress does like to look at our budget every year, but here is our best estimate of what our demand will be and what we think the commercial demand will be at the same time.

What we are trying to do there is to make the environment a little more stable, make decisions a little bit easier for raw materials suppliers or fabricators to invest in capital equipment or whatever they need to stay competitive in world markets.

On the information output side, we also run a Department of Defense Manufacturing Technology Program that gets into, among other things, materials processing. When we fund a manufacturing technology contract with a private company—let's say we have a contract to develop a better manufacturing technique for jet engine blades—and that company is through with its work for us, then we require the company to call in its peers and show how that new technique works, and it spins off into the private sector. Many, many projects are done on that same basis.

In fact, we are holding a conference next week, I believe, or next month, in June, on the R&D needs for metal matrix composites and things of that ilk where we bring industry in, show them what our long-term plans are, and then interchange with them on their capabilities.

I guess I will agree with you that more needs to be done on sharing information with the private sector, but we are sensitive to the idea of trying to get something accomplished. I chagrined a little bit in memory that, in many cases, like in our manufacturing technology efforts, robotics, computer-aided manufacturing, near net shape forging—forging a part closer to the element shape—the United States developed these projects. Many of them happened through Air Force, Army and Navy manufacturing technology contracts. What is disappointing is that the U.S. economy has yet to implement a lot of these technologies, and we will literally see computer-aided manufacturing carried out in other countries more extensively from information developed in the United States.

Mr. GLICKMAN. You wonder if the role model of the relationship between the Defense Department and the military industrial complex where a lot of these techniques were developed and used more closely coincides with the role model between Japanese Government and Japanese industry than does the role model with respect to all other industries in America. Again, I am not making a case for a planned central economy. But in truth and in fact, there is a very planned economy in the defense establishment of America that is much more so than the total competitive free economy of goods and services and other things because that is the way it has to be.

Of course, that is philosophical, and I don't expect you to get into all of that.

Mr. DONNELLY. I don't believe we have a planned economy, but there certainly are efforts to try to share our needs with the economy in general on what we need in the future.

Mr. GLICKMAN. Thank you.

Mr. McCandless.

Mr. MCCANDLESS. Thank you, Mr. Chairman.

In your prepared remarks, you talk about the implementation of the Defense Production Act and the Strategic and Critical Materials Stockpiling Act, and you refer to them as both fundamentally sound and that the administration is undertaking actions to improve the implementation of both acts.

From your viewpoint, is there something Congress could do, or anyone else for that matter, be it in the administration or out, that would assist in the implementation of those acts beyond that which is presently being done?

Mr. DONNELLY. Yes. I think it is time to shoot the engineer and get on with some programs, and I would ask for the committee support and for the individual member support for, for example, the $200 million program we have in fiscal year 1984 in the title III of the Defense Production Act area to actually move forward with some of these projects that will improve productivity of U.S. industry, supply of raw materials, get our weapons systems costs down, and things of that nature. We still need your help there in letting us move forward with our budgets to implement the projects that the Congress wanted us to develop in the first place.

Going back a couple of years, Mr. McCandless, there was a consensus here on the Hill within the House Armed Services Committee and the Banking Committee and here in this committee that the industrial base in the United States was eroding, that actions were needed to stop that erosion and to turn it around. We have got to the point now where we do have actions that will accomplish that turning around of the erosion, and we ask for your support in those projects.

Mr. MCCANDLESS. Thank you, Mr. Donnelly.

Mr. Chairman, you have covered the other areas that I was interested in.

Mr. GLICKMAN. I want to thank you for your testimony today. We appreciate you coming down here. I hope we can get this report out of OMB and into our hands as quickly as possible.

Mr. DONNELLY. Thank you, Mr. Chairman.

Mr. GLICKMAN. Thank you.

Our last witness—if we are lucky, we won't get a rollcall vote right away—is the representative of the Department of Commerce, Mr. Robert Wilson, Director, Office of Strategic Resources.

We thank you for coming here, Mr. Wilson. You may want to introduce your colleague. You have a very short statement, so you may just want to read that, or summarize as you deem appropriate.

STATEMENT OF ROBERT D. WILSON, DIRECTOR, OFFICE OF STRATEGIC RESOURCES, U.S. DEPARTMENT OF COMMERCE, ACCOMPANIED BY ORCUTT P. DRURY, DEPUTY DIRECTOR, OFFICE OF STRATEGIC RESOURCES, U.S. DEPARTMENT OF COMMERCE

Mr. WILSON. On my left is Orcutt P. Drury, who is the Deputy Director of my office.

Thank you, Mr. Chairman, members and staff of the subcommittee. We are pleased to be up here today and for the opportunity to testify before you on both our implementation of the 1980 act, as well as our part in implementing the President's Program Plan.

I will summarize the statement, as we are apparently short on time.

As part of our effort to assist in reducing the Nation's vulnerability to strategic and imported resources, the Department of Commerce established a departmental Minerals and Material Task

Force. Secretary Baldrige established my office in December 1981, and it was the first time the Department had a focal point on materials issues.

Specifically, our mandate is to provide overall direction and coordination for departmental activities relating to strategic resources. This includes chairing the DOC Minerals and Materials Task Force, which has representatives from the NBS, NOAA, the Bureau of Industrial Economics, and the International Trade Administration. It provides staff support for DOC participation in the Cabinet Council.

I would like to take this opportunity to clear up the record. Since November 12, 1981, the Department of Commerce has been a member of the Cabinet Council on Natural Resources and Environment. We will be happy to supply you a copy of the statement from the White House clarifying that point. So, GAO is incorrect on that point.

We are also responsible for fulfilling the mandate of the 1980 act, and we also conduct a business consultation program to determine the best means of addressing the material concerns of industries.

In the past year, my office has engaged in a wide variety of activities with a single aim: reducing the vulnerability of domestic industries to any disruption in the supply or price of materials. We have been working to accelerate the implementation of the materials and minerals program plan. It is our opinion that this plan provides a sound framework for Government activity in the materials area. We have participated enthusiastically in all phases of implementing this plan and have taken lead in initiating some work on the plan's action items.

In February of this year, my office called together Government Non-Fuel Resource Roundtable with representatives from all relevant Government agencies to discuss implementation of the plan. Following this meeting, we assembled an inventory of Government activities in this regard for industrial review and comment.

Next, we attempt to encourage industry to take action on their own to reduce their vulnerability. Last October we sponsored a Materials Risk Management Seminar to encourage materials users and processors to give higher priority to this issue in their corporate strategies.

We also seek to improve the confidence of industry in the readiness of the National Defense Stockpile. We have been very active in the stockpile quality assessment program initiated in September 1982. Since most of the stockpile acquisitions were made over 20 years ago, industry had been concerned that technological requirements for materials may have changed and that storage conditions may have caused some deterioration. A special panel has recommended an order of priorities for quality assessment and the proper testing procedures. Another panel, directed by the American Society for Metals, is in the process of conducting a detailed assessment of the cobalt in the stockpile, and developing a sampling and testing plan.

Next, we seek to enhance our understanding of materials use and materials supply problems. OSR has directed the preparation of two materials case studies required by the 1980 act, one of "Critical Materials Requirements of the U.S. Aerospace Industry,"

and one we have just finished of the "Critical Materials Requirements of the U.S. Steel Industry." We are now deciding upon the subject for a third study in this series.

One of the most important aspects of the OSR program is maintaining an open line to business and industry. We believe that it is essential that the producers, processors and consumers of materials have a voice in policy formulation. Twice in the past year, my office and the Office of Business Liaison in the Department have held briefings for industry on the Government's materials activities. We have actively solicited the views of participants on where more action needs to be taken. These briefings have helped us to target our resources on the most important materials needs of the industrial community, and we plan to continue this information exchange program.

In summary, it is our view that the implementation of the President's materials and minerals program plan is proceeding according to schedule. All agencies are fulfilling their assignments as specified in the plan and in the 1980 act. This does not negate, however, the need for continued coordination, ongoing review and new ideas and initiatives in the materials policy area. To this end, we will continue our efforts to achieve a more business-like approach to materials issues in the Government.

Thank you, Mr. Chairman. We will answer any questions.

[The prepared statement of Mr. Wilson follows:]

EMENT OF ROBERT DALE WILSON

DIRECTOR

OFFICE OF STRATEGIC RESOURCES

U.S. DEPARTMENT OF COMMERCE

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

MAY 17, 1983

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

Thank you for the opportunity to appear today to discuss materials policy and the implementation of the President's Materials and Minerals Program Plan. This Administration has taken seriously the mandate of the National Materials and Minerals Policy, Research and Development Act of 1980. The Program Plan submitted to Congress in April of last year was the product of an intensive interagency effort coordinated by the Cabinet Council on Natural Resources and Environment. It is important to remember that this Plan represents the first time in 30 years that an Administration has developed a specific set of objectives related to materials issues. I believe that the President's Plan provides a sound framework for Government activity in the materials area.

To coordinate its own activities under the Plan, the Department of Commerce established a Materials and Minerals Task Force. My office, the Office of Strategic Resources (OSR), was formed by Secretary Baldrige to oversee the Department's materials functions. This is the first time that the Department of Commerce has had a focal point for materials issues.

Specifically, the mandate of OSR is to "provide overall direction and coordination for Departmental activities relating to strategic resources." This includes:

- Chairing the Commerce Materials and Minerals Task Force which has representatives from the National Bureau of Standards, the National Oceanic and Atmospheric Administration, the Bureau of Industrial Economics, and the International Trade Administration.

- Providing staff support for Commerce participation in the Cabinet Council on Natural Resources and Environment.

- Representing Commerce in other interagency forums dealing with materials and minerals, such as the Committee on Materials (COMAT) and Law of the Sea discussions.

- Fulfilling the mandate of the National Materials and Minerals Policy, Research and Development Act of 1980 to carry out a series of materials case studies.

- Conducting a business consultation program to determine the best means of addressing the materials concerns of industry.

In the past year, we have engaged in a wide variety of activities with a single aim -- reducing the vulnerability of our domestic industries to any disruption in the supply of materials. OSR has been concentrating on four main objectives:

(1) Accelerate the implementation of the Materials and Minerals Program Plan. We are participating enthusiastically in all phases of implementing the Plan -- from preparing entries for the Minerals Data Source Directory to working with COMAT on improving our R&D strategy -- and have taken the lead in initiating work on some of the Plan's action items. In February 1983, OSR called together a Government Non-Fuel Resource Roundtable, with representatives from all relevant Government agencies, to discuss implementation of the Plan. Following this meeting, we assembled an inventory of Government activities in this regard for review by industry.

(2) Encourage industry to take action to reduce materials supply risks. OSR sponsored a Materials Risk Management Seminar to encourage materials users and processors to give higher priority to this issue in their corporate strategies, long-range planning, procurement and inventory policies, and research and development activities. Industry representatives shared information on techniques for identifying materials supply risks and for reducing those risks. We plan to sponsor a second Materials Risk Management Seminar later this year.

(3) Improve the confidence of industry in the readiness of the National Defense Stockpile. OSR has been very active in the stockpile quality assessment program, intitiated in September 1982. Since most of the stockpile acquisitions were made over twenty years ago, industry has been concerned that technological requirements for the materials may have changed and that storage conditions may have caused some deterioration. A special panel, under the auspices of the National Academy of Sciences, has recommended an order of priorities for quality assessment and testing procedures. Another panel, directed by the American Society for Metals, is in the process of sampling and testing the

cobalt in the stockpile. Other materials are to be assessed this year and appropriate actions taken to correct any deficiencies in the stockpiled materials.

(4) Enhance our understanding of materials use and materials supply problems. Under the requirements of the 1980 Act, OSR has prepared two materials case studies -- one of "Critical Materials Requirements of the U.S. Aerospace Industry" and one of "Critical Materials Requirements of the U.S. Steel Industry." We are now deciding upon the subject for a third study in this series. The first study provided much of the data and background information used in the development of the Administration's Materials and Minerals Program, while the second study has provided data for policy analysis in regard to the domestic ferroalloys industry. These studies give unique overviews of the materials needs and vulnerabilities of important U.S. industries and supply a new perspective on materials issues and policies.

One of the most important aspects of the OSR program is maintaining an open line to business and industry. We believe that it is essential that the views of producers, processors, and consumers of materials are heard by policymakers.

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Twice in the past year, OSR and the Commerce Office of Business Liaison have held briefings for industry on the Government's materials activities. We have actively solicited the views of participants on where more action needs to be taken. These briefings have helped us to target our resources on the most important materials needs of the industrial community, and we plan to continue this information exchange program.

In conclusion, I believe that the implementation of the President's Materials and Minerals Program Plan is proceeding according to schedule. Certainly, Commerce is committed to fulfilling its assignments as specified in the Plan and in the 1980 Act. This does not negate, however, the need for continued coordination, ongoing review, and new ideas and intiatives in the materials policy area. To this end, we will continue our efforts to achieve a better-managed and more responsive approach to materials issues in the Government.

Mr. GLICKMAN. Thank you very much.

Some Commerce officials, I think, some former ones—Deputy Secretary Wright and his successor, Mr. Fiske—have been critical in the past of the leadership provided in strategic materials policy of the Cabinet Council on Natural Resources and Environment. Could you characterize your Department's current attitude along these lines, given a year's experience with the Cabinet Council? Are there alternatives that might be better than the current method?

Mr. WILSON. Let me say first that I believe Secretary Baldrige testified early in 1981, right after the transition, that the executive branch was extremely uncoordinated in this area. Deputy Secretary Wright achieved certain fame talking about the lack of coordination in the executive branch, and former Deputy Secretary Fiske took the same line.

The current attitude is that the CCNRE has been designated as the coordinating agency. The Department of Commerce, in our self-proclaimed role as the department of business, looks continuously to make sure that these programs are managed well. If it appeared at some point in time that the plan was not being managed well, I am sure that officials in the Commerce Department would suggest something else.

We had, as I said, the roundtable meeting about 2 months ago in Commerce, and we have made a copy of the results available to your staff. There are a lot of activities out there, most of which are

coordinated. At this point, we continue to watch and assess the need for further coordination.

Mr. GLICKMAN. First of all, I want to compliment the Commerce Department for taking much greater initiative than the other departments in dealing with the areas, not only that you have complied with the statutory mandate that nobody has seen fit to do during the period, but the fact of the matter is that you have taken great initiative in dealing with some of the problem areas as well.

You have prepared basically, two studies. One is "Critical Materials Requirements of the U.S. Aerospace Industry," and the other one is "Critical Materials Requirements of the U.S. Steel Industry." I think they were both useful case studies. My question is will they simply be added to the long list of studies, or is action planned to implement their findings.

Mr. WILSON. Let me say, first, on the aerospace study that most of the policy recommendations of the aerospace study played directly into the implementation of our administration's plan that we submitted last April.

The original of the steel study has been submitted to Congress. Copies will be distributed once received back from the printer. That study was very useful in our analysis of trade problems in the ferroalloy industry. The ferroalloy analysis is not yet completed, insofar as the 232 action. We anticipate next year doing another analysis of the critical materials requirements of the defense industries. We do not feel that we are adding just to the long list of studies.

Mr. GLICKMAN. I am sorry. You said you anticipate——

Mr. WILSON. We are anticipating looking at the critical materials requirements of the U.S. defense industries over the coming year.

Mr. GLICKMAN. OK.

Mr. WILSON. I don't think the aerospace or steel studies were either just another Government study. We actively use them. We are looking forward to the defense study, which will involve a bit more active interagency coordination than we have had in the past to look at some of the basic processing problems, particularly the continuous declining processing capacity that we face in the country.

These studies are done by existing branches of Commerce—my office merely coordinates and edits those studies—NBS, ITA, BIE, and NOAA all work performed. It is not a great expense, and they are very useful to us. We have very good comments so far on the two that we have done.

Mr. GLICKMAN. Mr. Kogovsek had a couple of questions. He had to leave, so I will ask them to you.

The first question is, "The Commerce Department is the business arm of the administration representing the concerns of business. What do you see as the core minerals and materials problems and their solutions?"

Mr. WILSON. The problem has been the state of the economy, which occurred for several different reasons. We believe that, with the general upturn in the economy, the minerals and materials industries will benefit, although the lag time, particularly on the minerals industry, is typically 6 months or so after the rest of the economy. Probably the No. 1 problem is loss of the comparative ad-

vantage that we enjoyed in the past. The high labor costs, high energy costs and high regulatory costs, have added to the cost of the product. Other countries which do not face these costs——

Mr. GLICKMAN. And high subsidization overseas, as well.

I don't know how you feel, but I assume there is a pragmatic realization, since you are the business arm of Government, and since the Secretary himself has been so actively involved in changing the nature of the entire Department, that there is a recognition of the role of Government in dealing with that issue of foreign subsidies as it relates to our relationship with domestic industry.

Mr. WILSON. There is a recognition at the Commerce Department that there are those industries which are so vital to the national security industrial base that there are remedies on the books such as the 232, and the import tariffs and quota systems that can be put into effect in a given situation.

Mr. GLICKMAN. Or on the other side, industries like aeronautics that get affirmative support from the National Aeronautics and Space Administration because of the historical need that the Government can provide in the doing the R&D side of the picture.

Mr. WILSON. Right.

Mr. GLICKMAN. That is, of course, what we have been talking about today.

The second question that Mr. Kogovsek, he says, "I assume the research and development programs of Commerce address end-use technologies rather than exploration technologies. Could you briefly describe the types of R&D in your Department and how those programs are coordinated and integrated with the Department of Interior's R&D programs?"

Mr. WILSON. First of all, most of the research and development efforts made in the Department of Commerce are done by the National Bureau of Standards and, within that organization the Center for Materials Science. They are concerned primarily with processing and end-use techniques. The current initiatives are rapid solidification technology, composites, and graphites.

They coordinate their research activities through COMAT to other branches of Government. COMAT is responsible for coordinating materials R&D. COMAT in the last year was assembling an inventory of such R&D. There has been a meeting called by COMAT about 2 weeks ago to set up a new subworking group on essential materials R&D. That, I would say, will provide the formal structure. The informal structure is probably much more important. Most of the research scientists at NBS, Center for Materials Sciences, as well as those at DOE and DOD, work together with each other on projects, and have for years.

It troubles me that something could disturb that informal coordination, which is probably better than any type of formal arrangement we could ever establish. I am convinced that our Center for Materials Science fully coordinates it work, not only with the other departments, but with both academia and the private sector. They have fellowship programs where personnel from the private sector come to NBS and are involved in Federal R&D for a year at a time.

Mr. GLICKMAN. You talk about your Center for Materials Science, how did you feel about the establishment of this advanced materials laboratory at the Lawrence Berkeley Laboratories. Do

you think that that in any way duplicates the work that is being done?

Mr. WILSON. As I said, our Commerce efforts center primarily in the end-use and their processing techniques. I am not sure exactly what the management scheme for the new lab is, so until I see that, I would rather not comment on it.

Mr. GLICKMAN. Thank you.

Mr. McCandless.

Mr. MCCANDLESS. Thank you, Mr. Chairman.

In listening to your testimony and previous testimony by Mr. Donnelly, it would appear that there are parallel tracks with possible duplication in certain areas. Is that a fair assessment, or is it erroneous?

Mr. WILSON. In which area, sir?

Mr. MCCANDLESS. His development of strategic materials and the various things that go on in the Department of Defense in order to insure that those people who produce defense-oriented items have those materials; and you are in the private sector working with the private industrial complex developing materials, and so forth. That would indicate that both of you are in the private sector, only they are more defense oriented possibly than you are, but still our industrial complex does have a defense overtone.

Mr. WILSON. As I have learned about Government in the last 2 years, what appears to be at first glance an overlap sometimes is and sometimes it isn't. In particular, the DOD and Commerce coordination seems to be very good, and I don't believe there is any overlap. I know that we work very closely with DOD on some of the rapid solification technology programs. That doesn't mean there is overlap, that means that DOD performs certain functions of that research and Commerce performs other functions. DOD is naturally more mission oriented than we are. So, I really haven't seen any overlap between those two agencies.

Mr. MCCANDLESS. Is there a coordination between the two departments at any time if you find that you are both working on the same project or area?

Mr. WILSON. I know that at the last COMAT meeting, that there were two officials from the Center for Materials Sciences of NBS, and there were at least two people from DOD. They coordinate through that forum, but they also coordinate in working with each other each day.

Was that responsive to your question?

Mr. MCCANDLESS. Yes, thank you.

Thank you, Mr. Chairman.

Mr. GLICKMAN. Thank you, Mr. Wilson, for your testimony.

This concludes the hearing this morning. We will meet again tomorrow morning, and we will be dealing with issues of the strategic stockpile and minerals exploration. Our first witness is Harrison Schmitt, former U.S. Senator from New Mexico.

The hearing is adjourned.

[Whereupon, at 12:20 p.m., the subcommittee was adjourned.]

MATERIALS RESEARCH AND DEVELOPMENT POLICY

WEDNESDAY, MAY 18, 1983

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:30 a.m., in room 2318, Rayburn House Office Building, Hon. Dan Glickman (chairman of the subcommittee) presiding.

Present: Representative Glickman.

Mr. GLICKMAN. The hearing will come to order. This is the second day of hearings on the issue of materials research and development.

I have a statement from Mr. Carney that he would like as part of the record.

[The statement of Mr. Carney follows:]

OPENING STATEMENT
HON, WILLIAM CARNEY
CRITICAL MATERIALS HEARING
MAY 18, 1983

THERE ARE MANY WAYS TO ADDRESS CRITICAL MATERIALS ISSUES AS WE HEARD IN YESTERDAY'S TESTIMONY. CERTAINLY, ONE METHOD OF DEALING WITH THIS PROBLEM, AT LEAST IN THE SHORT TERM, IS TO ASSURE OURSELVES OF ADEQUATE SUPPLIES OF STRATEGIC MINERALS.

THIS ADMINISTRATION, VERY EARLY, RECOGNIZED THE RISK TO OUR SECURITY IN RELYING ON THIRD-WORLD COUNTRIES FOR OUR STRATEGIC MATERIALS NEEDS, AND HAS TAKEN STEPS TO REDUCE OUR VULNERABILITY IN THIS AREA.

HOWEVER, MANY QUESTIONS REMAIN CONCERNING THE MANAGEMENT OF STRATEGIC STOCKPILES AND ALSO HOW WE CAN INCREASE OUR DOMESTIC PRODUCTION OF STRATEGIC MATERIALS WITHOUT DOING IRREPARABLE DAMAGE TO OUR ENVIRONMENT.

I'M CONFIDENT THAT OUR EXPERT WITNESSES HERE TODAY HAVE SOME THOUGHTS ON THESE DIFFICULT QUESTIONS. I'M LOOKING FORWARD TO THEIR SHARING THESE WITH US TODAY.

Mr. GLICKMAN. I also have a statement by Mr. Charles Bennett of Florida that he has asked be put in the record.

[The statement of Mr. Bennett follows:]

STATEMENT OF

CHARLES E. BENNETT, Chairman
Subcommittee on Seapower and Strategic and Critical Materials
Committee on Armed Services

Before the

Subcommittee on Transportation, Aviation and Materials
Committee on Science and Technology
U.S. House of Representatives

Regarding

The National Defense Stockpile of
Strategic and Critical Materials

May 18, 1983

STATEMENT FOR THE RECORD BY
THE HONORABLE CHARLES E. BENNETT, CHAIRMAN,
SUBCOMMITTEE ON SEAPOWER AND STRATEGIC AND CRITICAL MATERIALS
HOUSE COMMITTEE ON ARMED SERVICES

May 18, 1983

Thank you for the opportunity to present my views about strategic and critical materials to your Subcommittee on Transportation, Aviation and Materials.

Basic research is essential and can lead to the reduction of industry's consumption of such strategic metals as cobalt, columbium, chromium and tantalum.

As you know, the requirement for one jet engine is roughly 900 pounds of cobalt, 1500 pounds of chromium, 170 pounds of columbium and 3 pounds of tantalum. Anything that we can do to provide alternative concepts and materials which could substantially reduce consumption of such high temperature metals will reduce the requirements for them in the national defense stockpile.

Unless there is an unforeseen technological break-through the long-range aspects of research and development seem to be the most promising to reduce these requirements. Such long-range efforts cannot be counted on to reduce stockpile requirements in the near future. Thus, our planning goals for stockpile materials should not be changed because of a gleam in the eye of a researcher. Only when R&D efforts produce substitute materials that have been proven, should we consider changing stockpile goals.

Your oversight hearings on materials policy will inevitably result in some discussion of stockpile policy. The reason this is so inevitable is that materials in our national defense stockpile are far below the quantity and quality that every agency in government knows it should be.

In testimony before the Seapower and Strategic and Critical Materials Subcommittee on June 2, 1981, administration witnesses pointed out our critical material problems, including this nation's vulnerability to supply shortages, and the need for $13 billion of purchases to bring the stockpile up to essential and established goals.

On April 5, 1982 the President submitted to Congress the National Materials and Minerals Program Plan. In that report the President said "This Administration will rely primarily on the strategic stockpile as the primary means of providing for national defense objectives."

However, I am sorry to say that both past and present administrations have continued the liquidation of excess strategic materials without the comparable purchase of materials in short supply. For example, the Reagan Administration, in its first year, as part of the Budget Reconciliation Act of 1981, proposed the sale of $2.14 billion dollars of excess stockpile commodities while proposing the purchase of only $120 million of needed stockpile materials.

With the exception of small quantities of bauxite and cobalt that were added in 1982 there have been no significant additions to the stockpile in the last 20 years. The principal reason for this lack of action seems to be that we have neither had the national will to act, nor have we had a logical organizational arrangement for the management of the stockpile nor a focal point to serve as a strong advocate for a reasonable stockpile program.

The Office of Management and Budget has been the part of each Administration which has failed to approve an aggressive procurement policy, probably to make the budget look good.

As members of the Committee on Science and Technology well know, the purpose of the national defense stockpile is to insure against critical materials shortages in times of defense emergencies. During wartime, the stockpile would provide quickly needed materials to be converted to military equipment and munitions. Just as important, the stockpile would help to reduce lead times and demands on manpower, energy, productive capacity, scarce machinery, and transportation incident to mining and processing raw materials that would create additional demands in the defense wartime environments.

Based on the April 30, 1983 GSA report on inventory of stockpile material, the stockpile deficit is $10.6 billion. Again the fiscal year 1984 purchase request for the stockpile

is only $120 million which is, however you look at it, inadequate funding to attain satisfactory levels of security. To put this in perspective I would remind the subcommittee that during the six month period of January 1, 1948 to June 30, 1948 (a peacetime period) the United States purchased $126 million of strategic and critical materials for the stockpile. This level of expenditure in today's dollars would be equivalent to $500 million for a six month period, or an annual purchase of $1 billion.

At the present annual rate of $120 million funding for stockpile purchases, it would take over 80 years to erase the present stockpile deficit. A dangerous risk.

To overcome, at least in part, the lack of direct authorization and appropriation I have advocated for some time the barter of surplus agricultural products and other excess federal properties for strategic and critical materials for the national defense stockpile. This path seems to have many statutory roadblocks at present, and a great amount of administrative lethargy.

We are exploring a method that was provided for in the 1979 Strategic and Critical Materials Stock Piling Act, but for some reason very little has been done about it. That is the acquisition of stockpile materials through the transfer to the stockpile of excess government materials which are now being disposed of as scrap.

In my mind, one of the principal reasons the stockpile program is floundering is that there is no single agency which is responsible for its management. There is no real national Defense Stockpile manager. We need a single organization with the responsibility to plan for this stockpile, to integrate stockpile requirements with war plans, and to prepare and defend the budget through the executive department prioritization and congressional authorization and appropriations. In short, we need a stockpile manager with centralized direction.

I introduced H.R. 7414 last year and H.R. 33 this year to centralize management of the national defense stockpile under one head, the Defense Department.

So far we have had one day of hearings on H.R. 33. There was support from industry and outside witnesses, but here again obviously orchestrated by the Office of Management and Budget each of the Administration witnesses opposed the proposed legislation on very superficial and essentially unbelievable grounds.

It is my hope that in time the President will recognize that a stockpile manager for the defense stockpile in a single department of the government is the logical way to manage the stockpile. If the concept of H.R. 33 is not acceptable to the Executive Branch, then perhaps a better alternative can be suggested.

In this regard, I am concerned that your subcommittee is pointing toward new legislation similar to your proposed Critical Materials Act of 1981 (H.R. 4281) of last year which would have set up an R&D czar who would attempt to manage and direct all efforts to develop new or substitute materials. My concern about this aspect of your hearings arises in part from the House of Representatives Report 97-761, Part I, in which you state, "The Council on Critical Materials would oversee the multitude of Federal materials programs.... and act as the Federal government's focal point to analyze and evaluate materials policy as it would concern our energy, environmental, minerals, defense and foreign policies, among others." This language appears to want to give to this council authority over defense stockpile matters, which are already suffering from too many bosses. Also, your committee does not have jurisdiction over the defense stockpile. Moreover, it is quite possible that much more progress could be made if R&D for scarce materials is done on a competitive basis by the private sector without the intervention of the government.

I would favor some form of industry-government advisory committee to identify those few instances where government participation would be necessary to promote specific materials-related research and development. The industry-government advisory committee could be established within the current governmental framework without creating another government agency and the need to appropriate additional taxpayer dollars.

Mr. GLICKMAN. In today's hearings we will turn to the strategic stockpile and to technology for evaluating domestic mineral resource potential.

The objective of the stockpile is to sustain the Nation with respect to strategic and critical minerals and materials during a 3-year national emergency. In effect, the stockpile is intended to provide valuable short-term insurance against the contingency of future supply interruptions during such an emergency. As currently structured, there are at least four major problems with the stockpile: The quantity of materials stockpiled, its quality, the influence of outside political pressures and, finally, internal management. These issues were addressed during the 97th Congress by the Senate Subcommittee on Science, Technology and Space, and we are happy to have the leader of that effort, Senator Schmitt, with us this morning.

With regard to minerals exploration, it is clear that an adversarial relationship has developed between the Nation's mining community and those who are concerned with the environment. The mining community claims that the Nation's mineral resources are locked up while environmentalists express concern about tearing up the national parks and wilderness areas. Neither side has produced answers to a more fundamental question; namely, are there in fact any critical materials-rich public lands in the United States?

The purpose of this hearing is to provide a forum to consider information from the environmental community and mining interests regarding exploration technologies and policies for critical minerals. This portion of the hearings will hopefully provide useful ideas for improving our domestic resource capability, while addressing the needs of these two divergent communities. For example, I am interested in knowing what improvements in technology are required to allow precise location and to assess the quality and quantity of minerals without compromising the environment.

I would like to thank all of our witnesses for joining us this morning, and I look forward to your testimony.

I mention that the House goes in at 10 this morning, so we may be faced with a series of votes, which I know that Senator Schmitt understands, but for those of you have not been here before, we may have to put this on recess for a few minutes while I go vote.

Our first witness today is a very distinguished gentleman, Harrison Schmitt, a former U.S. Senator from New Mexico, who was perhaps one of the most active Members of Congress on issues affecting the stockpile and critical materials. It is a pleasure to have you here, Senator.

Your entire statement will appear in the record. You may read it if you wish, or summarize.

STATEMENT OF HON. HARRISON SCHMITT, A FORMER SENATOR FROM THE STATE OF NEW MEXICO

Mr. SCHMITT. Mr. Chairman, knowing the restraints on your time and also the number of witnesses that I am sure you have to appear before you this morning, I will not attempt to read my statement, and would only summarize very briefly. If there are any

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questions on that statement, I certainly will be happy to answer them.

Basically, Mr. Chairman, my thesis generally is that we are in a strategic materials crisis situation. We have been for some time. We have a significant number of materials that are imported from either politically unstable countries or from the Soviet Union itself.

In addition, as a matter of national policy, or lack of policy, in the last several decades we have seen the stockpile actually move further away from its stated goals rather than closer to those goals. I think, as you will see in my testimony, that there is ample evidence that the stockpile has been managed for either politial or budgetary purposes rather than for the purposes for which it is intended, namely national defense, and, to a lesser degree, protection of our national economy.

Having studied this issue, not only for my 6 years in the U.S. Senate, but having been involved in the minerals industry directly or indirectly for most of my life, I have come to the conclusion that we have a structural problem in the management of the stockpile. I am convinced that there are far too many players in the game for the current organizational structure to adequately meet our vital national interests.

Therefore, as you know, in the last Congress I introduced a bill, a copy of the latest version of which has been made available to the subcommittee, which would provide for the creation of an independent stockpile commission, not closely, but conceptually modeled after the Federal Reserve Board. There are, of course, many differences. But still, the idea of having an independent board still under the influence and potentially under the legislative thumb of the Congress, but which everybody recognizes is there to manage a national resource in the most business-like way possible with the national interests totally in mind. A Strategic Stockpile Commission, I think, is the proper way to proceed.

The advantages for the Nation are given below—I will not list the disadvantages. I think we can get into that later. Obviously, there is no perfect solution. But the advantages, in my opinion, far outweigh the disadvantages.

First, the management of the stockpile would be removed from political and budgetary manipulation. There is a litany of political and budgetary manipulation that I think is very clear on the record. Numerous studies have exposed it. I don't doubt that your subcommittee is well aware of that.

Second, sales and purchases could be conducted quietly so as not to disrupt markets or benefits speculators. As the chairman, I am sure, is aware that if there is a decision to try to sell something from the stockpile that is in excess, it takes months for that decision to work its way through the agencies and through the Congress and, by that time, the opportunity to sell high has disappeared and, invariably, we end up selling low. When we need to buy something, we almost invariably buy high, as has been the case in cobalt over the last couple of years.

Third, in addition to sales of excess assets, funds for purchases could be allocated from Federal sales or scrap and real property. There are many sources of income that could, I think, philosophi-

cally and legitimately be applied to the purchase of stockpile assets that may be in deficiency.

Fourth, the stockpile materials could be fully and regularly inventoried and rotated as necessary. That requires no further explanation.

Fifth, market opportunities could be used to avoid the seemingly perpetual buy high/sell low syndrome we have seen in the stockpile management in recent decades.

Sixth, one agency would be responsible for stockpile management rather than the seven agencies, plus Congress, that are directly involved today.

Finally, in time of national emergency, the President would have a single professional agency to direct in allocating the stockpile for the purposes of that emergency. The bill does make provisions that, in a state of national emergency, the President would assume the direction and responsibilities of the board.

Mr. Chairman, there is no question in my mind and, I think, in the minds of all thoughtful persons who have been looking at this issue for some time that we are currently involved in a materials war. The only problem is, as a Nation and as a matter of national policy, we don't recognize that war; however, the Soviet Union does. My testimony describes some of the history and geographical realities of that war, and I commend it to your attention. There is no question, however, that we must develop a better policy infrastructure than we have today if we are going to emerge as victors in that war, or at least be able to protect our vital national interests.

I would be happy to answer any questions that you might have, Mr. Chairman.

[The prepared statement of Mr. Schmitt follows:]

NATIONAL MATERIALS POLICY:
A STRATEGIC STOCKPILE COMMISSION

TESTIMONY
BY

HARRISON H. SCHMITT

HEARINGS ON MATERIALS POLICY

BY THE

SUBCOMMITTEE ON

TRANSPORTATION, AVIATION AND MATERIALS

CONGRESSMAN DAN GLICKMAN, CHAIRMAN

NATIONAL MATERIALS POLICY:
A STRATEGIC STOCKPILE COMMISSION

MR. CHAIRMAN, MEMBERS OF THE SUBCOMMITTEE, THANK YOU FOR THIS OPPORTUNITY TO SPEAK WITH YOU ON A SUBJECT OF GREAT CONTINUING INTEREST FOR ME AND OF GREAT CONTINUING DANGER FOR THE COUNTRY.

THE LESSONS FROM THE PAST IN MINERAL SUPPLY ARE THE BITTER ONES, LESSONS STILL LARGELY UNLEARNED AS REGULATION, TAXATION, AND DEMAGOGUERY MAKE US MORE DEPENDENT ON UNSTABLE FOREIGN SOURCES OF SUPPLY.

AS WE LOOK TO SOLVE PRESENT AND FUTURE PROBLEMS, IT IS WELL TO REMEMBER A FEW FACTS OF GEOGRAPHY, NATURE AND HISTORY.

FIRST OF ALL, WE ARE A MARITIME NATION, THAT IS, THE OCEANS, THE ATMOSPHERE, AND NOW MORE AND MORE, THE NEW OCEAN OF SPACE, ARE THE DETERMINING FACTORS IN OUR COMMERCIAL AND POLITICAL RELATIONS WITH OTHER PEOPLES AND OTHER NATIONS.

SECONDLY, NATURE ENDOWED US WITH UNBELIEVABLY VAST NATURAL RESOURCES, MOST OF WHICH HAVE NOT BEEN TAPPED, CONTRARY TO THE UNINFORMED OR MISGUIDED STATEMENTS OF MANY IN LEADERSHIP POSITIONS.

THIRDLY, HISTORY SHOWS THAT GEOGRAPHY AND NATURE ALLOWED US TO IGNORE THE WORLD FOR 140 YEARS, THEN ACT AS THE WORLD'S BENEFACTOR AND PROTECTOR FOR THE NEXT 40 YEARS, THEN BECOME DEPENDENT UPON THE INTERNATIONAL WHIMS OF OTHERS IN JUST THE NEXT 25 YEARS. THE LAST 6 OR 8 YEARS HAVE BEEN POTENTIALLY CATASTROPHIC IN THIS REGARD.

AS A MARITIME NATION WITH VAST NATURAL RESOURCES AND AN EQUALLY VAST AND EXPANDING INTERNAL MARKET, WE COULD AFFORD TO IGNORE THE WORLD FOR THOSE FIRST 140 YEARS.

AS TECHNOLOGY COLLAPSED THE WORLD IN UPON US, THE SURVIVAL OF OUR NATION AND ULTIMATELY, THE SURVIVAL OF FREEDOM, DEMANDED THAT WE ENTER THE WORLD ARENA, FIRST AS PROTECTOR IN WAR AND THEN AS BENEFACTOR IN PEACE. FOR 40 YEARS WE PLAYED THAT DUAL ROLE AS REQUIRED, AND PLAYED IT WITH YOUTHFUL IDEALISM, AND ECONOMIC AND ENVIRONMENTAL ABANDON THE LIKE OF WHICH THE WORLD HAD NEVER SEEN.

THEN, TIME, TECHNOLOGY, AND INEXPERIENCE CAUGHT UP WITH US.

THE STALEMATE IN KOREA AND THE FAILURE IN VIETNAM COMBINED WITH THE FALSE ECONOMICS OF OVER-SPENDING AND REGULATION AT HOME SEEMED TO TAKE AWAY OUR CONTROL OF OUR OWN DESTINY IN JUST A FEW YEARS. THIS LOSS OF CONTROL HAS BECOME OBVIOUS TO ALL WITH INCREASING CLARITY DURING THE '70'S AND EARLY '80'S.

IT DID NOT HAVE TO BE THUS; BUT IT IS.

THERE ARE SOME OTHER RELEVANT FACTS TO REMEMBER:

1. OUR PRINCIPAL COMPETITOR IN THE BATTLE BETWEEN FREEDOM AND OPPRESSION IS THE LEADERSHIP OF THE SOVIET UNION. THE SOVIET UNION IS A LARGE CONTINENTAL NATION WITH EVEN MORE VAST NATURAL AND HUMAN RESOUCES THAN WE AND WITH GREAT AMBITION.

2. ALTHOUGH THE UNITED STATES STILL HAS VAST UNTAPPED NATURAL RESOURCES, BY HISTORY, ECONOMICS AND POLICY WE COULD NOT NOW NOR COULD WE QUICKLY BECOME SELF-SUFFICIENT IN MANY ESSENTIAL MINERAL RESOURCES.

3. THE SOURCES OF THE U. S. AND FREE WORLD SUPPLIES OF MOST STRATEGIC MINERAL IMPORTS LIE IN POLITICALLY UNSTABLE REGIONS OF THE WORLD.

4. RECENT U. S. FOREIGN POLICY HAS CREATED A CHAIN OF EVENTS WHICH, IF THEY PROCEED UNCHECKED, WILL RESULT IN DIREST OR INDIRECT SOVIET CONTROL OF THESE SOURCES OF SUPPLY.

5. RECENT U. S. DEFENSE POLICY HAS MADE IT UNLIKELY THAT THE SHIPPING LANES OF THE FREE WORLD CAN BE PROTECTED FROM EXTENSIVE AND PROLONGED INTERDICTION BY SOVIET FORCES.

RECENT U. S. MINERAL EXPLORATION, RESEARCH AND DEVELOPMENT AND STRATEGIC STOCKPILE POLICIES DO NOT RECOGNIZE ANY OF THESE FACTS.

IT IS WELL TO RECOGNIZE FULLY OUR MINERAL SITUATION RELATIVE TO THE SOVIET UNION.

1. SINCE WORLD WAR II, THE SOVIET UNION HAS EMPHASIZED MINERAL SELF-SUFFICIENCY. THE UNITED STATES HAS TAKEN NO SIGNIFICANT STEPS TOWARD SELF-SUFFICIENCY AND SEEMS TO DISREGARD THIS AS A MATTER OF NATIONAL PRIORITY. IN FACT, THE U. S. TAX AND REGULATORY POLICIES HAVE BEEN DIRECTLY COUNTER TO DOMESTIC MINERAL EXPLORATION AND PRODUCTION.

2. THE SOVIET UNION RESTRICTS CONSUMPTION OF MINERALS IF NECESSARY TO AVOID IMPORT DEFICIENCIES. THE UNITED STATES, WITH A FREE CONSUMER ECONOMY, PLACES NO LIMITATIONS ON CONSUMPTION. RESEARCH AND DEVELOPMENT ON ALTERNATIVE MATERIALS IS MINISCULE; ENCOURAGEMENT OF INCREASED RECYCLING IS LIMITED; AND OTHER CONSERVATION POLICIES OF THE U. S. HAVE BEEN ONLY MARGINALLY EFFECTIVE.

3. THE SOVIET UNION IS A MAJOR EXPORTER OF MINERALS AND USES

MINERAL EXPORTS TO OBTAIN FOREIGN CURRENCY AND INFLUENCE. THE UNITED STATES IMPORTS OF MINERALS ARE STEADILY INCREASING. THE NET EFFECT OF THIS HAS BEEN TO ADD TO THE PRESSURES WEAKENING U. S. FOREIGN POLICY TOWARD THE LESS DEVELOPED, BUT MINERAL-RICH, COUNTRIES.

4. SOVIET POLICY IN AFRICA STRONGLY SERVES SOVIET INTERESTS. TURMOIL IN AFRICA WILL STRENGTHEN THE PRICES OF SOVIET EXPORTS AND SOVIET LEVERAGE ON U. S. FOREIGN AND DOMESTIC POLICIES. U. S. POLICY IN AFRICA IS DICTATED ENTIRELY BY SHORT-TERM POLITICAL CONSIDERATIONS AND NOT ON AN INTEGRATED VIEW OF ALL U. S. INTERESTS. IN FACT, THE RHODESIAN EMBARGO, AS A CASE IN POINT, WAS COMMERCIALLY DISADVANTAGEOUS TO THE UNITED STATES AND VERY ADVANTAGEOUS TO THE SOVIET UNION AND THE NEW, UNHAPPY NATION OF ZIMBABWE NO BETTER OFF FOR IT.

5. WHILE THE SOVIET UNION EXPRESSES SENTIMENTS OF INTEREST IN THE THIRD WORLD, IT HAS IN FACT NOT MATERIALLY ASSISTED DEVELOPING COUNTRIES IN EXPANSION OF THEIR MINERAL INDUSTRIES. THE UNITED STATES HAS MADE CAPITAL AVAILABLE ON FAVORABLE TERMS AND HAS EXTENDED TRADE CONCESSIONS WHICH HAVE SERVED TO UNDERCUT U. S. EXPLORATION AND PRODUCTION IN THE ABSENCE OF INTEGRATED FOREIGN AND STRATEGIC MINERALS POLICIES.

6. EXPLOITATION OF SOVIET MINERAL DEPOSITS IS IN NO WAY INHIBITED BY ENVIRONMENTAL CONSIDERATIONS. IN THE UNITED STATES, THE PROLIFERATION OF ENVIRONMENTAL AND SAFETY REGULATIONS WITHOUT BALANCING TAX INCENTIVES PUTS A HEAVY BURDEN OF CAPITAL AND OPERATING

COSTS ON THE MINERAL INDUSTRIES. IN SOME INSTANCES, REGULATIONS ARE FORCING PRODUCERS TO SUSPEND OPERATIONS. PRIVATE GROUPS ARE PERMITTED, AND INDEED ENCOURAGED BY LAW, REGULATION AND BUREAUCRATS, TO DELAY AND HINDER MINERAL DEVELOPMENT THROUGH LITIGATION RATHER THAN WORKING TO FIND BALANCE BETWEEN CONSERVATION AND DEVELOPMENT.

OUR MAJOR STRATEGIC MINERAL DEFICIENCIES ARE FRIGHTENING.

COBALT, 91 PERCENT DEPENDENT ON IMPORTS. COBALT IS ABSOLUTELY ESSENTIAL FOR JET AIRCRAFT ENGINES AS WELL AS MANY OTHER PURPOSES. THE QUALITY OF THE CURRENT 45-MILLION-POUND STOCKPILE IS UNCERTAIN. THIS STOCKPILE IS ONLY ABOUT 53 PERCENT OF ITS GOAL AND IT IS UNLIKELY TO BE ABLE TO SUPPLY OUR DEFENSE "SUPER ALLOY" NEEDS FOR MORE THAN A YEAR IN A CRISIS. THE EARLIEST THAT TWO POSSIBLE DOMESTIC PRODUCERS COULD COME ON LINE TO SUPPLY JUST THE SUPER ALLOY NEEDS IS THREE YEARS. EVEN THIS ESTIMATE ASSUMES THAT THE NECESSARY DEVELOPMENT WORK, MAINTENANCE ACTIVITY AND REFINERY PLANNING HAS BEEN DONE TO CREATE A "WARM" INDUSTRIAL BASE.

CHROMIUM, 90 PERCENT DEPENDENT ON IMPORTS. CHROMIUM IS PARTICULARLY CRITICAL IN THE MANUFACTURE OF SPECIALTY STEELS. THERE ARE NO DEVELOPED DOMESTIC CHROMITE DEPOSITS, MUCH LESS ANY THAT COULD BE BROUGHT INTO PRODUCTION TO SATISFY THE CONSUMPTION RATES OF FERRO-CHROME REQUIRED FOR DEFENSE PURPOSES. OUR STOCKPILE IS 200,000 TONS SHORT OF ITS GOAL AND WE ARE DEPENDENT ON AN UNSTABLE ZIMBABWE AND AN UNFRIENDLY SOVIET UNION FOR IMPORTS.

ALUMINUM, 94 PERCENT ON IMPORTS. ALUMINUM IS THE MAINSTAY OF A VAST ARRAY OF DEFENSE EQUIPMENT IN THE AIR, ON LAND AND AT SEA. ALTHOUGH IT IS THEORETICALLY POSSIBLE TO PRODUCE ALUMINUM FROM LOW-GRADE CLAYS IN THE U. S., NO MINES OR REFINERIES EXIST WHICH COULD HOPE TO MEET OUR NEEDS IN THE NEAR-TERM. NO PRACTICAL SUBSTITUTE EXISTS FOR ALUMINUM MINED AND REFINED IN JAMAICA AND OTHER COUNTRIES AND OUR STOCKPILE IS LESS THAN HALF OF THE 638,000 TON GOAL.

TITANIUM, 43 PERCENT DEPENDENT ON IMPORTS. TITANIUM, AS DISCUSSED EARLIER, IS NOT ONLY THE METAL OF OUR AGE, BUT IS INCREASINGLY CRITICAL TO NATIONAL DEFENSE USES IN AIRCRAFT, TANKS AND SHIPS. THE POTENTIAL OF DOMESTIC PRODUCTION CAPACITY IS GREATLY LIMITED BY GEOLOGY WHILE OUR STOCKPILE IS ONLY ABOUT 16 PERCENT OF ITS 195,000 TON GOAL.

THIS LITANY OF HORRORS GOES ON AND ON AND IS MADE WORSE BY THE OVER-ALL INADEQUACY OF BOTH STRATEGIC MATERIALS POLICY AND THE MANAGEMENT OF THE STRATEGIC STOCKPILE. THE DOMESTIC COPPER INDUSTRY, FOR EXAMPLE, IS DISAPPEARING BEFORE OUR VERY EYES.

NO MODERN PRESIDENT OR CABINET HAS BEEN ABLE TO ASSOCIATE THE IMPLICATIONS OF THESE DEFICIENCIES WITH FOREIGN, DEFENSE AND DOMESTIC POLICIES. OUR POLICIES HAVE PREVENTED THE CONTAINMENT OF SOVIET AMBITIONS, HAVE ELIMINATED OUR ABILITY TO PROTECT THE SEA LANES, AND HAVE DESTROYED THE INCENTIVES AND CAPABILITY TO CREATE DOMESTIC ALTERNATIVES TO IMPORTS.

THOSE POLICIES HAVE PLACED THIS GREAT NATION ON THE VERGE OF DISASTER.

THERE IS NOT MUCH TIME LEFT TO BEGIN TO DO THINGS RIGHT FOR A CHANGE.

WHAT BASIC POLICIES SHOULD WE FOLLOW?

FIRST, THE POLICY OF GEOGRAPHICAL CONTAINMENT OF SOVIET AMBITIONS SHOULD BE REINSTITUTED AND VIGOROUSLY PURSUED BY BOTH OUR FOREIGN AND DEFENSE POLICIES, PARTICULARLY WHERE SOURCES OF SUPPLY OF STRATEGIC RESOURCES ARE THREATENED.

SECOND, THE NAVAL AND RAPID DEPLOYMENT FORCES NECESSARY FOR A POLICY OF CONTAINMENT AND FOR THE DEFENSE OF THE SEA LANES MUST BE RAPIDLY PROCURED.

THIRD, FOREIGN POLICY TOWARD RESOURCE-RICH, ECONOMICALLY-POOR NATIONS SHOULD BE BASED ON THE TRANSFER OF KNOW-HOW THAT WILL RAPIDLY REDUCE HUNGER, DISEASE, POVERTY AND IGNORANCE, THUS REMOVING, OVER TIME, THE NATURALLY DESTABILIZING FORCES WITHIN SUCH NATIONS.

FOURTH, OUR DOMESTIC ENVIRONMENTAL POLICY SHOULD BE A BALANCED POLICY USING LARGELY NON-DESTRUCTIVE TECHNOLOGIES TO RAPIDLY ASSESS THE STRATEGIC MINERAL POTENTIAL OF FEDERAL LANDS SO THAT DECISIONS MADE WITH RESPECT TO EACH CRITICAL MATERIAL CAN BE MADE ON THE BASIS OF FACT RATHER THAN IGNORANCE.

FIFTH, COOPERATIVE RESEARCH AND TECHNOLOGY DEVELOPMENT PROGRAMS, MODELED AFTER THE NASA AERONAUTICS PROGRAMS, SHOULD BE CREATED THAT

WILL SEARCH FOR SUBSTITUTES FOR MATERIALS IN WHICH WE ARE MOST VULNERABLE TO CUT-OFFS OF SUPPLY AND LEAST ABLE TO STOCKPILE, MINE OR REFINE FROM DOMESTIC SOURCES.

A CRITICAL COMPONENT OF THESE BASIC POLICIES IS THE PROPER MANAGEMENT OF THE STRATEGIC STOCKPILE AND IN-THE-GROUND STRATEGIC RESERVES. MANY, INCLUDING MYSELF, HAVE RECOMMENDED THE CONSOLIDATION OF THE HODGEPODGE OF STOCKPILE MANAGEMENT RESPONSIBILITIES UNDER A SINGLE INDEPENDENT COMMISSION.

LEGISLATION IS NEEDED WHICH WOULD CONSOLIDATE THE STOCKPILE RELATED FUNCTIONS OF THE GENERAL SERVICES ADMINISTRATION AND THE FEDERAL EMERGENCY MANAGEMENT AGENCY INTO A STRATEGIC STOCKPILE COMMISSION. THIS IMPROVED STRUCTURE FOR THE IMPLEMENTATION OF THE STRATEGIC AND CRITICAL MATERIALS STOCKPILING ACT WILL INSURE THAT THE IMPORTANT IMPROVEMENTS WHICH HAVE BEEN MADE IN THIS ACT IN RECENT YEARS CAN BE EFFICIENTLY AND EFFECTIVELY ADMINISTERED.

LET ME REVIEW FOR A MOMENT THE NEED FOR THIS LEGISLATION.

THE NATIONAL DEFENSE STOCKPILE EXISTS TO INSURE THAT OUR COUNTRY CAN CONTINUE TO HAVE VITAL DEFENSE MATERIALS IN TIMES OF NATIONAL EMERGENCY. WE COULD ALMOST THINK OF IT AS OUR NATIONAL SURVIVAL PACK OF STRATEGIC MATERIALS.

BUT OUR STOCKPILE IS IN TROUBLE. SHORT-SIGHTED POLITICAL CONSIDERATIONS HAVE FREQUENTLY TAKEN PRIORITY OVER STRATEGIC ISSUES IN THE SETTING OF OUR STOCKPILE GOALS. ADMINISTRATIONS HAVE SOMETIMES SEEN THE STOCKPILE AS A SORT OF CHECKING ACCOUNT TO BE TAPPED WHEN-

EVER WE NEED TO RAISE MONEY TO HELP BALANCE THE BUDGET OR FUND A NEW PROGRAM. EVEN THE FEW SOUND PROPOSALS HAVE OFTEN BEEN BLOCKED BY CONGRESS BECAUSE OF LOCAL SPECIAL INTERESTS. AS A RESULT, IT IS ESTIMATED THAT THE STOCKPILE IS SOME $14 BILLION SHORT OF ACHIEVING CURRENT GOALS.

THE PRESENT SYSTEM OF MANAGEMENT HAS ACTUALLY BEEN COUNTERPRODUCTIVE. WE APPEAR TO MOVE FURTHER AWAY FROM OUR GOALS AS TIME GOES BY. I AM NOT AWARE OF ANY MORE DEVASTATING INDICTMENT OF THE CURRENT METHOD OF STOCKPILE MANAGEMENT THAN THE SIMPLE FACT THAT THE ACTIVITIES OF THE PAST TWENTY YEARS HAVE MADE OUR COUNTRY MORE DEPENDENT AND MORE VULNERABLE TO SUPPLY INTERRUPTIONS OF STRATEGIC MATERIALS. IN SHORT, MR. CHAIRMAN, THIS RECORD OF MISMANAGEMENT IS NOTHING LESS THAN A NATIONAL DISGRACE AND AN EMBARRASSMENT TO THE GOVERNMENT.

THE FEDERAL EMERGENCY MANAGEMENT AGENCY ESTIMATES THAT HAD THE STATUS QUO OF 1962 BEEN MAINTAINED, THE COST OF ACHIEVING CURRENT STOCKPILE GOALS WOULD HAVE BEEN MINIMAL AND THERE WOULD BE VALUABLE SURPLUSES OF HIGH VALUE COMMODITIES SUCH AS COPPER, ALUMINUM, ZINC, COBALT, NICKEL AND LEAD.

SOME OF THE GENERAL PROBLEMS IN THE CURRENT MANAGEMENT OF OUR NATIONAL STOCKPILE ARE THE FOLLOWING:

(1) STOCKPILE GOALS HAVE BEEN CHANGED FREQUENTLY IN THE PAST, BUT NOT ALWAYS CONSISTENTLY. FOR EXAMPLE, AT ONE TIME STOCKPILE GOALS FOR ALUMINUM, COPPER, LEAD, NICKEL AND ZINC WERE SET AT ZERO. DURING THE PERIOD OF 1963-1975, ALL OF THE STOCKPILED

ALUMINUM, COPPER AND NICKEL WAS SOLD, AS WAS MOST OF THE ZINC AND ABOUT HALF OF THE LEAD. NEW STOCKPILE GOALS FOR THESE MATERIALS WILL REQUIRE THEIR PURCHASE AT CURRENT MARKET PRICES, WHICH ARE FAR HIGHER THAN THE PRICES AT WHICH THESE COMMODITIES WERE SOLD.

(2) THE STOCKPILE HAS FREQUENTLY BEEN MANIPULATED FOR NON-DEFENSE POLITICAL PURPOSES CONTRARY TO THE STATUTORY REQUIREMENT THAT DIRECTS OTHERWISE. THE INITIATIVES OF THE NIXON ADMINISTRATION TO SELL OFF A MAJOR PORTION OF THE STOCKPILE, PRESUMABLY TO GENERATE REVENUE TO REDUCE FEDERAL BUDGET DEFICITS, ARE A CASE IN POINT. THE CURRENT ADMINISTRATION'S RECOMMENDATION IN THE LAST CONGRESS TO SELL $2.14 BILLION WORTH OF STOCKPILED MATERIALS, BUT TO PURCHASE ONLY $60 MILLION WORTH OF NEW MATERIALS FOR THE STOCKPILE, HARDLY INSPIRES CONFIDENCE THAT THE STOCKPILE IS NOT STILL BEING USED FOR BUDGETARY PURPOSES.

(3) THE STORAGE AND HANDLING OF SOME STOCKPILED MATERIALS HAS BEEN LESS THAN SATISFACTORY; POOR SECURITY MAY HAVE RESULTED IN THEFT; WEIGHING OF MATERIALS PRIOR TO SALE MAY HAVE BEEN INACCURATE; MATERIAL HAS BEEN ALLOWED TO DETERIORATE OR BECOME OBSOLETE; AND BILLING FOR SOLD MATERIALS HAS BEEN FAULTY.

(4) THE FACT THAT FUNDS DERIVED FROM PAST SALES OF STOCKPILED MATERIALS HAVE GONE INTO THE TREASURY'S GENERAL FUND, RATHER THAN BEING USED TO PURCHASE NEEDED MATERIALS FOR THE STOCKPILE, HAS SERIOUSLY DEPLETED THE ASSETS OF THE STOCKPILE.

LET'S LOOK AT HOW OUR STOCKPILE HAS FARED UNDER THESE PAST

POLICIES WITH REGARD TO SOME SPECIFIC MATERIALS:

COBALT

THE STOCKPILE GOAL FOR THIS MATERIAL WAS 129 MILLION POUNDS IN 1955 BUT ONLY ABOUT 12 MILLION POUNDS IN 1973; CONSEQUENTLY MUCH COBALT -- APPROXIMATELY 60 MILLION POUNDS -- WAS SOLD AT PRICES AVERAGING $2 TO $4 A POUND. RECENTLY THE ADMINISTRATION BOUGHT OVER 10 MILLION POUNDS OF COBALT FROM ZAIRE FOR $12-$15 A POUND. IN OTHER WORDS, WE ARE PAYING $10 OR MORE PER POUND MORE FOR COBALT TODAY THAN WE SOLD IT FOR ONLY A FEW YEARS AGO. MORE CONSISTENT AND REALISTIC MANAGEMENT OF THIS MATERIAL CLEARLY WOULD HAVE SAVED MUCH MONEY.

ZINC

THE STOCKPILE GOAL FOR ZINC WAS ABOUT 1.5 MILLION TONS IN 1950 BUT WAS REDUCED TO ZERO IN 1963. SALES HAVE REDUCED THE AMOUNT STOCKPILED TO LESS THAN 400,000 TONS; YET THE CURRENT STOCKPILE GOAL HAS BEEN RAISED AGAIN TO MORE THAN 1.4 MILLION TONS.

THERE IS A CURIOUS IRONY HERE. AT THE END OF 1963, THE STOCKPILE CONTAINED 1,580,741 TONS OF ZINC -- SLIGHTLY ABOVE THE PRESENT OBJECTIVE. FOR VARIOUS REASONS, INCLUDING THE SIZE OF THE DOMESTIC INDUSTRY AT THAT TIME, THE DEFENSE AUTHORITIES CONCLUDED THAT NO STOCKPILE OF ZINC WAS REQUIRED.

OVER THE SUBSEQUENT YEARS MORE THAN THREE-QUARTERS OF THE STOCKPILE WAS SOLD -- AT PRICES AVERAGING PERHAPS $300 A TON. ONE EFFECT OF THESE STOCKPILE SALES WAS, OF COURSE, TO HOLD THE ZINC PRICE

DOWN. THAT, IN TURN, DISCOURAGED INVESTMENT IN MODERN INDUSTRIAL PLANT AND HELPED BRING ABOUT THE DRAMATIC DECLINE IN THE INDUSTRY'S CAPACITY. BECAUSE THE CAPACITY IS DOWN, GOVERNMENT HAS CONCLUDED THAT IT NEEDS A BIG STOCKPILE AGAIN. AND WHAT IS THE PRICE THE GOVERNMENT WILL HAVE TO PAY FOR ZINC? IT IS CURRENTLY ABOUT $900 A TON -- SOME $600 MORE THAN THE PRICE THE GOVERNMENT RECEIVED FOR ZINC SOLD FROM THE STOCKPILE.

LEAD

IN 1956 THE STOCKPILE GOAL FOR LEAD WAS ALMOST 1.2 MILLION TONS, BUT BY 1963 THE GOAL HAD BEEN REDUCED TO ZERO. ALMOST 1.4 MILLION TONS WERE STILL BEING STOCKPILED IN 1962, BUT SUBSEQUENT SALES HAVE REDUCED THIS AMOUNT TO ABOUT 600,000 TONS. YET, THE CURRENT STOCKPILE GOAL FOR LEAD IS ABOUT 1.1 MILLION TONS, THUS REQUIRING ADDITIONAL PURCHASES.

COPPER

AT ONE TIME THE STOCKPILE GOAL FOR COPPER WAS 3.5 MILLION TONS; THIS WAS REDUCED TO ALMOST 800,000 TONS BY 1963 AND FURTHER REDUCED TO ZERO BY 1973. MORE THAN 1.1 MILLION TONS OF COPPER WERE IN THE STOCKPILE IN 1962, BUT SALES REDUCED THE AMOUNT TO 260,000 TONS BY 1973 AND MOST OF THIS HAD BEEN SOLD BY 1974. THE CURRENT GOAL FOR COPPER IS 1.0 MILLION TONS, BUT THERE IS LESS THAN 30,000 TONS IN THE STOCKPILE. THE COST TO BUY BACK THE COPPER SOLD FROM THE STOCKPILE WILL BE SUBSTANTIAL, AND IT IS A COST THAT COULD HAVE BEEN AVOIDED WITH SOUND MANAGEMENT OF OUR RESOURCES. NOW WE ARE FACED WITH A DISAPPEARING DOMESTIC INDUSTRY AS WELL AS A STOCKPILE DEFICIENCY.

SILVER

CURRENTLY THERE IS MORE CONTROVERSY OVER THE MANAGEMENT OF SILVER THAN FOR ANY OTHER STOCKPILED MATERIALS. AT PRESENT, THE STOCKPILE CONTAINS 139.5 MILLION TROY OUNCES OF SILVER, WHEREAS THE GOAL AS BEEN SET AT ZERO, LARGELY ON THE GROUNDS THAT ADEQUATE SUPPLIES OF SILVER DURING WARTIME COULD BE OBTAINED FROM DOMESTIC SOURCES AND FROM IMPORTS FROM CANADA AND MEXICO. CONSEQUENTLY, 1981'S BUDGET ACT AUTHORIZED THE SALE OF 46.537 MILLION TROY OUNCES AS OF OCTOBER 1, 1981; 44.682 MILLION TROY OUNCES AS OF OCTOBER 1, 1982; AND 13.9 MILLION TROY OUNCES AS OF OCTOBER 1, 1983. CONGRESSIONAL ACTION HAS SINCE PUT A STOP TO THESE SALES.

CRITICS OF THESE SALES CONTEND THAT IN VIEW OF THE SHARP CHANGES IN THE STOCKPILE GOALS IN THE PAST, THERE IS NO GUARANTEE THAT THE GOAL FOR SILVER MAY NOT BE AGAIN CHANGED, THUS REQUIRING REPURCHASE OF SILVER, POSSIBLY AT MUCH HIGHER PRICES. THEY ALSO NOTE THAT OF THE $2.140 BILLION RECOMMENDED IN STOCKPILED MATERIALS SALES, SILVER AMOUNTS TO ABOUT $2.093 BILLION. HENCE THEY SUGGEST THAT THE SALE OF SILVER IS BEING PROMOTED MORE FOR BUDGETARY THAN FOR DEFENSE PURPOSES. FURTHER, THE MANNER IN WHICH THESE AND OTHER SALES HAVE BEEN CONDUCTED RAISES SERIOUS QUESTIONS REGARDING GSA'S ABILITY TO CONDUCT THESE SALES WITHOUT NEEDLESSLY DISRUPTING THE MARKET.

CHROMIUM

CHROMIUM IS A VITAL STRATEGIC MATERIAL NEEDED FOR MANUFACTURING OF A WIDE RANGE OF ESSENTIAL MILITARY EQUIPMENT. IN LIGHT OF THE FACT THAT THE UNITED STATES IMPORTS 91% OF OUR CONSUMPTION, THE

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AVAILABILITY OF CHROMIUM IS A MATTER OF GREAT CONCERN. YET, 682,000 SHORT TONS OF CHROMIUM HAVE BEEN SOLD FROM THE STOCKPILE SINCE 1962 -- AND THE STOCKPILE IS NOW NEARLY 200,000 TONS SHORT OF ITS GOAL.

THESE ARE JUST A FEW EXAMPLES OF THE INADEQUACY OF STOCKPILE MANAGEMENT WITH REGARD TO A FEW OF THE VITAL STRATEGIC MATERIALS IN OUR STOCKPILE.

WHAT IS THE ESSENTIAL MESSAGE OF THIS LITANY OF STOCKPILE MANAGEMENT INEFFICIENCIES? IT IS THIS: THE NUMBER, AND EXTENT TO WHICH, A LONG LIST OF MATERIALS HAVE BEEN MISHANDLED SUGGESTS THAT STRUCTURAL AND ORGANIZATIONAL PROBLEMS EXIST WHICH REQUIRE A FUNDAMENTAL CHANGE IN THE MANAGEMENT STRUCTURE OF THE STRATEGIC STOCKPILE. TO BE CLEAR, MR. CHAIRMAN, MY CRITICISM IS NOT DIRECTED AT FEMA AND GSA, OR TO ANY INDIVIDUALS WITHIN THOSE AGENCIES. THE PROBLEM LIES IN THE STRUCTURE THAT HAS BEEN ESTABLISHED WITHIN WHICH THE PERSONNEL OF THESE AGENCIES MUST OPERATE. I AM PERSUADED THAT THE FOLLOWING ELEMENTS MUST BE A PART OF ANY COMPREHENSIVE SOLUTION TO THE PROBLEMS I HAVE DISCUSSED.

-- MANAGEMENT OF THE STOCKPILE NEEDS TO BE CONSOLIDATED. AT PRESENT, STOCKPILE MANAGEMENT IS FRACTURED AND DISORGANIZED. SALES AND PURCHASES OF MATERIALS ARE MADE BY THE GENERAL SERVICES ADMINISTRATION -- BUT ONLY UPON THE RECOMMENDATION OF THE FEDERAL EMERGENCY MANAGEMENT AGENCY WHICH COLLECTS INFORMATION AND RECOMMENDATIONS FROM THE DEPARTMENTS OF DEFENSE, COMMERCE, INTERIOR, STATE AND OTHERS TO ESTABLISH STOCKPILE GOALS. BUT IT DOESN'T STOP THERE. FEMA PROPOSALS TO BUY AND SELL MATERIALS ARE TRANSMITTED TO OMB, WHERE

BUDGETARY CONSIDERATION MAY WEIGH IN HEAVILY ON STOCKPILE DECISIONS. THIS, I BELIEVE, IS THE SOURCE OF MANY OF THE CHANGES IN STOCKPILE GOALS THAT HAVE OCCURRED IN THE PAST SEVERAL ADMINISTRATIONS. ALL TOO OFTEN, GOALS HAVE BEEN MANIPULATED DOWNWARD TO JUSTIFY STOCKPILE SALES THAT WOULD RAISE REVENUES TO REDUCE THE FEDERAL DEFICIT.

AFTER OMB HAS TAKEN A LOOK AT AND PROBABLY REVISED FEMA'S STOCKPILE PROPOSALS, CONGRESS CONSIDERS THE ADMINISTRATION'S RECOMMENDATION IN THE ANNUAL BUDGET. REGRETTABLY, CONGRESS HAS FREQUENTLY GONE ALONG WITH THE EXECUTIVE BRANCH'S BUDGETARY ABUSE OF THE STOCKPILE. FURTHER, THE CONGRESS HAS, ON OCCASION, BEEN PERSUADED BY SPECIAL INTEREST GROUPS TO ADOPT STOCKPILE POLICIES WHICH MAY HAVE BEEN HELPFUL TO PARTICULAR INDUSTRIES, BUT WHICH IN THE LONG RUN, CREATE MORE PROBLEMS FOR THE ACHIEVEMENT OF STOCKPILE GOALS.

I AM CONVINCED THAT THERE ARE FAR TOO MANY PLAYERS IN THIS GAME FOR THE CURRENT ORGANIZATIONAL STRUCTURE TO ADEQUATELY MEET OUR VITAL NATIONAL INTERESTS. FURTHERMORE, NO ONE IN GOVERNMENT HAS SOLE RESPONSIBILITY FOR THE STOCKPILE. GSA AND FEMA BOTH HAVE VERY BROAD RESPONSIBILITIES IN DIVERSE AREAS -- STOCKPILE MANAGEMENT IS BUT ONE OF THEIR MANY FUNCTIONS; ONE WHICH IS FREQUENTLY SHORT-CHANGED.

-- MANAGEMENT OF THE STOCKPILE SHOULD BE ABLE TO RESPOND TO MARKET INFLUENCES; BUT THE CURRENT SYSTEM HAS MONTHS OF DELAY BUILT INTO IT, BEFORE A SALE OR PURCHASE CAN BE INITIATED. WE WERE ONLY RECENTLY SELLING SILVER AT $8-$9 PER OUNCE AND DRIVING THE PRICE LOWER WITH THE SALES, TO THE DETRIMENT OF OUR DOMESTIC PRODUCERS. WHERE

WAS GSA WHEN THE PRICE OF SILVER PEAKED AT $50 PER OUNCE? THEY WEREN'T IN THE MARKET. THEY COULDN'T HAVE BEEN, IT WOULD TAKE MONTHS TO GET APPROVAL FROM THE EXECUTIVE BRANCH AND CONGRESS!

-- MATERIALS IN STOCKPILE MAY NEED TO BE ROTATED FROM TIME TO TIME TO INSURE THAT THEY MEET CURRENT INDUSTRY SPECIFICATIONS. MY UNDERSTANDING IS THAT SIGNIFICANT PORTIONS OF OUR COBALT STOCKPILE DOES NOT MEET CERTAIN HIGH TECHNOLOGY USES AND WOULD REQUIRE COSTLY AND TIME CONSUMING REPROCESSING IN A TIME OF NATIONAL EMERGENCY. SUCH A ROUTINE ROTATION OF STOCKPILED MATERIALS SHOULD NOT REQUIRE CONGRESSIONAL OR EXECUTIVE BRANCH INVOLVEMENT, AND ACCOMPANYING DELAY.

-- MANAGEMENT OF SALES AND PURCHASES SHOULD AT TIMES BE CONDUCTED QUIETLY SO AS NOT TO DISRUPT THE MARKET OR "TELEGRAPH" OUR INTENTIONS. YET, BY VIRTUE OF THE FACT THAT STOCKPILE PURCHASES AND SALES MUST BE CONGRESSIONALLY AUTHORIZED, THE WHOLE WORLD HAS AN IDEA OF WHAT THE MANAGERS OF THE STOCKPILE WILL BE DOING -- AND THEY CAN ACT ACCORDINGLY. TO SOME EXTENT, STOCKPILE SALES AND PURCHASES PROVIDE AN OPPORTUNITY FOR SPECULATORS AND PRODUCERS, FOREIGN AND DOMESTIC ALIKE TO PROFIT FROM THE UNREASONABLE AND UNWORKABLE SYSTEM WE HAVE CONSTRUCTED.

-- MANAGEMENT OF THE STOCKPILE SHOULD BE REMOVED TO THE MAXIMUM EXTENT FROM POLITICAL OR BUDGETARY CONSIDERATIONS. THE PURPOSE OF THE STOCKPILE IS TO PROVIDE A DEGREE OF PROTECTION TO OUR COUNTRY IN TIME OF WAR OR EMERGENCY. IT WAS NOT CREATED AS A BUDGET BALANCING TOOL. WE MUST RESTORE THE STOCKPILE TO ITS ORIGINAL PURPOSE. ALTHOUGH CONGRESSMAN BENNETT'S PROPOSAL TO CONSOLIDATE STOCKPILE MANAGEMENT IN

DOD HAS SOME ADVANTAGES, POLITICAL AND BUDGETARY MISMANAGEMENT CAN STILL INTRUDE.

THE ESTABLISHMENT OF A STRATEGIC STOCKPILE COMMISSION WOULD GO A LONG WAY TOWARD SOLVING MANY OF OUR MATERIALS PROBLEMS. FURTHERMORE, IT WOULD CENTRALIZE IN ONE AGENCY ALL OF THE PARTICIPANTS IN THE MANAGEMENT OF THE STOCKPILE. THERE WOULD BE ONE VOICE IN GOVERNMENT THAT COULD SPEAK WITH AUTHORITY ON THE NATURE AND EXTENT OF MATERIALS PROBLEMS. THIS VOICE IS CURRENTLY MISSING. FURTHER, THE ESTABLISHMENT OF A STRATEGIC STOCKPILE COMMISSION WOULD REMOVE, TO THE MAXIMUM EXTENT POSSIBLE, THE BUDGETARY AND POLITICAL MANIPULATION OF OUR NATIONAL STOCKPILE.

THROUGH INTERGOVERNMENTAL AND PRIVATE SECTOR CONSULTATION THE STRATEGIC STOCKPILE COMMISSION WOULD SET THE APPROPRIATE GOALS AND STRATEGIES FOR EACH STRATEGIC COMMODITY. THEN ITS CHARTER WOULD BE TO WORK TOWARD AND MAINTAIN THOSE GOALS IN AS PRUDENT AND AS NONDISRUPTIVE WAY POSSIBLE, UTILIZING THE ASSETS OF THE STOCKPILE AND THE AUTHORITIES OF THE DEFENSE PRODUCTION ACT.

IN SUMMARY, AN INDEPENDENT STRATEGIC STOCKPILE COMMISSION HAS MANY ADVANTAGES FOR THE NATION:

1. MANAGEMENT OF THE STOCKPILE WOULD BE REMOVED FROM POLITICAL AND BUDGETARY MANIPULATION.

2. SALES AND PURCHASES COULD BE CONDUCTED QUIETLY SO AS TO NOT DISRUPT MARKETS OR BENEFIT SPECULATORS.

3. IN ADDITION TO SALES OF EXCESS ASSETS, FUNDS FOR PURCHASES COULD BE ALLOCATED FROM FEDERAL SALES OF SCRAP AND REAL PROPERTY.

4. STOCKPILE MATERIALS COULD BE FULLY AND REGULARLY INVENTORIED

AND ROTATED AS NECESSARY.

5. MARKET OPPORTUNITIES COULD BE USED TO AVOID THE SEEMINGLY PERPETUAL "BUY HIGH, SELL LOW" SYNDROME WE HAVE SEEN IN STOCKPILE MANAGEMENT IN RECENT DECADES.

6. ONE AGENCY WOULD BE RESPONSIBLE FOR STOCKPILE MANAGEMENT RATHER THAN THE SEVEN PLUS CONGRESS THAT ARE DIRECTLY INVOLVED NOW.

7. IN TIME OF NATIONAL EMERGENCY, THE PRESIDENT WOULD HAVE A SINGLE PROFESSIONAL AGENCY TO DIRECT IN ALLOCATING THE STOCKPILE FOR THE PURPOSES OF THAT EMERGENCY.

THE UNITED STATES IS CURRENTLY INVOLVED IN A MATERIALS WAR. THE ONLY PROBLEM IS, AS A NATION WE DON'T KNOW IT -- AND THE SOVIETS DO. THERE ARE MANY ACTIONS WHICH MUST BE TAKEN TO COUNTER THIS THREAT -- CHANGES IN FEDERAL LANDS POLICY, TAXES, POLLUTION CONTROL, INITIATIVES IN DEEP-SEA MINING, ETC., SO THAT WE CAN DEVELOP OUR OWN RESOURCES AND ATTAIN SELF-SUFFICIENCY WHEREVER WE CAN.

BUT THERE ARE MANY MATERIALS WITH WHICH THE UNITED STATES IS NOT ENDOWED IN ABUNDANCE. WHERE THIS IS THE CASE, THE STOCKPILE IS OUR BEST METHOD OF PROTECTING OUR COUNTRY AND OUR ECONOMY. WITH CERTAIN OTHER MATERIALS WE HAVE DOMESTIC DEPOSITS WHICH ARE NOT CURRENTLY IN PRODUCTION, BUT WHICH MAY BE IN THE FUTURE WITH ADVANCES IN TECHNOLOGY OR WITH APPROPRIATE PRODUCTION INCENTIVES. IN THESE CASES THE STOCKPILE CAN SERVE A VITAL FUNCTION IN BRIDGING US OVER TO THE DAY WHEN WE CAN BECOME SELF-SUFFICIENT.

ONE OF OUR PRIMARY POLITICAL PROBLEMS IN WASHINGTON IS THAT THE CONGRESS IS SO MUCH ABSORBED IN THE IMMEDIATE ISSUES OF TODAY THAT THERE IS RARELY ATTENTION GIVEN TO OUR LONG-TERM STRUCTURAL PROBLEMS. MINERALS DEPENDENCY IS SUCH A LONG-TERM PROBLEM AND IT REQUIRES A LONG-TERM STRUCTURAL SOLUTION. THIS LEGISLATION, A COPY OF WHICH IS ATTACHED, I BELIEVE CAN PLAY A PART IN ACHIEVING THAT SOLUTION.

Mr. GLICKMAN. Thank you.

I have not read your complete testimony, but the staff has, and they say that it is excellent and quite comprehensive in dealing with, not only the historical background, but the stockpile itself, which is one of the reasons we asked you here.

Let me ask you a few questions, if I might.

Mr. SCHMITT. Surely.

Mr. GLICKMAN. You talk about this resource war and you refer to it in your testimony. Some people argue that the resource war is an illusion, and that the Soviet Union is now active in world minerals markets because development and exploitation of domestic resources is uneconomical, the weather is bad and the area has poor transportation where these critical minerals are mined. Therefore, this view considers that the Soviets are invoking capitalistic economics to the extent of seeking economic sources of materials while directing their limited financial resources to higher priority domestic needs.

I wonder how you feel about this, the interpretation of some, who consider this as the alternative reason why the Soviets are moving in this direction, as opposed to a resource war?

Mr. SCHMITT. Mr. Chairman, I think it is hogwash, with all due respect to whomever may have said it. The Soviet Union has a historical pattern of a true continental power, as we were for about the first 140 years of our history. Now we are a maritime nation and will continue to be so.

The Soviet Union has, as a matter of national policy, insured that, for the foreseeable future, they will be almost entirely independent of imports of strategic materials. There are some exceptions to that possibly developing, but don't underestimate the ability of a nation as large and geologically diverse as the Soviet Union to provide for their internal needs for an indefinite period of time, including their needs in energy. Despite of projections that they may become an importing nation, I think it is safe to say they will not in the near future be dependent on imports for energy or material needs.

The only area of great deficiency in the Soviet Union which is strategic in nature is, of course, in agriculture, and the free world continues to supply those needs without any major hesitation over the range of time that I am familiar with.

If you do not think that the United States is in a serious situation, you only have to look at a few of the more serious deficiencies that we face. We have, for example, a 90 to 95 percent dependency on imports of cobalt, almost entirely from what has to be considered a political unstable region of the world, and that is Central and Southern Africa. The cobalt is a strategic material.

There are some ideas that, over the long term, we might develop substitutes, but there has been no concentrated national effort on such substitutes for cobalt or other major strategic materials. I suggest in my testimony that we should organize a national effort much like we did for aeronautics in 1914 and continued with the National Advisory Committee on Aeronautics, subsequently continued into NASA, in order to build that research and technology base necessary for materials substitutes over the long haul. But in the meantime, we are dependent on imports.

There is an alternative with respect to cobalt, and I mention this principally to illustrate that every commodity has its own scenario that has to be evaluated, and I think can best be evaluated by an independent board with great expertise. In cobalt, we do have a natural resource base. It just happens that it would cost us two to three times more than the world market price to produce from that resource base.

I, and Noranda and Anschutz, have suggested to the Department of Defense and others in the Government that an alternative to subsidizing production or buying the full resource necessary for the stockpile from foreign sources is to create an in-the-ground reserve, one which could be warm—that is, within 2 years, you could get to initial production, and maybe slightly sooner. Well within 3 years, we could have full production of 8 million to 10 million pounds of cobalt a year.

That has many advantages over the previous suggestions. First of all, it doesn't require significant mining. It preserves the resource base until you absolutely have to have it—hopefully, never. Second, it does act as a constraint, a limit on manipulation of the cobalt market by foreign sources.

Every commodity has a different scenario. I will mention only one other, and that is copper, and dear to my heart in New Mexico, where we do have also a domestic resource base and a previously strong domestic industry. But, because of the inability of that industry to compete in costs, it is gradually disappearing. We are rapidly approaching in copper the same situation that we face in cobalt.

Anaconda today, a major historic mining company in copper, does not smelt any of their concentrates in the United States; rather, they ship them to Japan. That situation is going to accelerate, I am afraid, unless the Government recognizes that it must do something to either preserve that industry or insure that it is kept in a warm condition in case there is an interruption of supply.

Mr. GLICKMAN. Let me ask you a question as you related it to copper. We had administration witnesses yesterday, especially Interior Department witnesses, who seemed to be cautious of getting the Government involved in any way except perhaps in the stockpile. Our ferroalloys smelters are now virtually extinct, given today's market forces. Testimony received yesterday from the administration was the traditional market force ideas that I have been hearing a great deal about.

How do you feel about those? Are they relevant in connection with the materials and minerals issues?

Mr. SCHMITT. Mr. Chairman, depending on market forces is always relevant, if you can get away with it or if there are no other overwhelming considerations. In the case of many minerals—each commodity, again, is a different case—but in the case of many, the international marketplace is not a free market. The free trade syndrome within this administration, and it tends to be a national characteristic—I won't blame just this administration, but it is certainly strong there—has tended to blind the policymakers to the specific situations or specific vulnerabilities we face in various materials commodities.

My firm belief is that you cannot just hide behind that doctrine of belief in free trade where your national defense and national economic security, is at stake. You have to look at each case and decide whether free trade is going to work or whether it is not going to work.

In addition to that, in my ramblings and "lost patrol" activities through the administration in recent months, I have become absolutely convinced that, in this issue as well as in all long-term and mid-term industrial base issues, there is no policy framework within the Government—within the Congress or within the administration—that is available to deal with these kinds of issues. The short-term deficiencies are very real and they are overwhelming. The ability of the Congress or this administration to create a policy framework that deals with the mid-term and long-term industrial base issues, not just in the minerals industry—it happens to be one of the more fundamental—but also in steel and in other basic industries. A nation that hopes to stay free cannot afford to be largely dependent on imports to compensate for its own deficiencies.

Mr. GLICKMAN. The bill, that you referred to, talked about creating an independent Stockpiling Commission and related matters. I was intrigued about something you said earlier concerning the use of NASA as a model for the science and materials science side of the picture.

One of the problems we saw yesterday was that we have set up a Cabinet Council that is headed by Secretary Watt, and there is a Committee on Materials as a part of that Cabinet Council. Under the statute, they were required to begin materials assessment, and they have not complied with the statute. The only agency that has is the Commerce Agency. The Department of Defense has sent it to OMB, but we have nothing. The Interior Office and the President's Science Office have just ignored the statute.

I wonder if you would have any thoughts specifically on structural changes in Government that might deal with some of these problems—maybe using the NASA model or taking your Stockpiling Commission idea and expanding it?

Mr. SCHMITT. Mr. Chairman, I think there are a number of structural changes or modifications that can be made. I tend, I guess from my science background, to look back and see where we have experimented and experiments have worked in Government. History is really the only evidence we have of what will work in social institutions and governmental institutions. Fortunately in this case, and in many others, we know that we have done things right. We tend to forget that we have done things right, but we have.

In terms of the broad-base raising of our technology base, we have two models to look to that have been very, very successful. One is the one I mentioned, the National Advisory Committee on Aeronautics, which was the precursor of NASA. The success of that effort is absolutely clear to everyone that looks at the origin of aircraft sold in this world. The United States is at the pinnacle of aircraft sales and, so long as we maintain a strong research and technology base, we will stay there.

You note that I use the term "research and technology." It is a term-of-art within NASA and within the aeronautics part of NASA, as distinguished from research and development. Research

and technology means you are not developing total systems, you are developing components, materials, and the technology base from which somebody else will build those systems. It has worked, and we should not hesitate to use that experience in other endeavors where we need to broaden our total technology base. Certainly, materials substitutes is one such area.

The other example, which probably is not as relevant here, would be relevant to certain aspects of energy conservation, however, is the Agriculture Extension Service. We often forget that the agricultural revolution was a revolution in the expansion of a technology base. The idea of an Extension Service through the land grant colleges was extraordinarily successful. Again our success is evident in the fact that it was too successful. We can't figure out what to do with all of the agricultural products, food and fiber, that we produce. But, again, that is a model that could be used for these purposes. It worked principally because, in that case, we needed a distributed technology base, we went to the land grant colleges and other parts of our university system for the development and management of that technology base, and kept it away from Washington.

There was an Energy Extension Service, and there may still be on paper. I believe it was a little bit before your time. It was invested while I was Director of NASA's energy program. I made the suggestion in these same halls that we ought to use that Agricultural Extension Service as a model for energy extension and integrate the two. It would have worked, I am sure. Unfortunately, Washington, the Department of Energy and its predessor, ERDA, were unwilling to give up control, and they tried to manage it out of Washington, and you almost never hear of it. It has failed.

Mr. GLICKMAN. In the materials area, we are going to authorize a new National Materials Laboratory at the Lawrence Berkeley Laboratory. NASA does, of course, some materials work, and NASA knew nothing about the lab at Lawrence Berkeley at the time that it was announced. I sense now that a lot of people are becoming interested in the issues, "Hey, we have a minerals problem. We have a materials problem. This is all part of the national industrial recovery problem." Immediately, the same thing happens as always happens—chaos, lack of any structural organization. Of course, if you become too organized, you lose spontaneity, as you mentioned with the Energy Extension Service. I didn't realize this at first. I thought that it really didn't matter. We shouldn't argue too much about structure and organization. We just want the work to be complete. But the fact of the matter is that it does make a difference.

Mr. SCHMITT. It does.

Mr. GLICKMAN. It looks to me like everybody now wants a piece of the action.

Congressman Bennett has argued, by the way, on the stockpile issue, that we ought to give that over to the Defense Department to manage. I wonder how you feel about that?

Mr. SCHMITT. Mr. Chairman, first of all, let me say that I think that there are some structural problems with having the materials issue run out of one of the national laboratories. I am a great supporter of the national laboratories system for the purposes that it

has performed so well in the past. However, because of the past, because of the cultural imprint of the past on those labs, I think they are going to have a very difficult time doing what NASA did with Langley, with Ames and with the Lewis research facilities in aeronautics, and that is to build a broad technology base in which industry and academia participate as equal partners.

I should make it very clear, and I wish more people would recognize that, when Government does that, it does exactly what MITI does in Japan, and we have been doing it since 1914—we bring the industry out from under the constraints of the antitrust laws, we let it work together with Government and with academia to build a technology base, and then take that technology out back underneath the antitrust laws where they ought to be in a free competitive economy. That works. We know it works. Nobody has done it better than we have, if we would just do it again.

I am afraid, though, that the cultural imprint of the national lab system, of which Livermore is one—it is certainly one of the most outstanding research institutions in the world—will make it very difficult for that tripartie relationship to develop that needs to develop in materials substitutes.

Congressman Bennett, I think, has made some very, very important contributions, not only in these recent suggestions, but throughout his career on this issue. I think that there are some advantages to what he proposes. My only concern is that, if the control is in the Department of Defense, it is still subject to the political and budgetary manipulations that will come from OMB, and that is where our problem has been, at least on the administration's side. Congress, in itself, has not been immune to political and budgetary manipulations of the stockpile. All one has to do is look at the history of silver to see that.

Personally, I think we need a large stockpile of silver, but not for the reason that most people believe. I look back again in history and see that, in an international crisis, it is a good idea to have something people are willing to take in payment besides paper money. Probably that is the biggest reason to have a significant silver stockpile.

Mr. GLICKMAN. That raises an interesting question on the basis of the stockpile. You have aptly pointed out that you must deal with this on a commodity-by-commodity issue. You have mentioned a unique reason to have a stockpile of silver, unrelated to any materials needs.

I am just curious if you could give us your thoughts on whether there is still a basis for an aggregate stockpile to sustain the Nation with respect to strategic and critical materials during a long-term national emergency. Is it meaningful in today's world of nuclear weapons as much as it was 20, 25 or 30 years ago?

Mr. SCHMITT. Yes, sir. I believe it is more meaningful because, in an atmosphere of nuclear weapons, although the magnitude of the consequences of a nuclear exchange are greater than we have ever seen in history, there is, I think, a lower probability of that occurring than other forms of war have occurred in the past. In that situation, we are going to be subject to threats, foreign policy threats of various kinds. And if we are vulnerable to cutoff of either our sources or our lines of supply relative to strategic materials, we are

vulnerable then to, in a sense, blackmail in foreign relations independent of any nuclear threat. The fact is, I think it more likely that the Soviet Union, particularly, will use their increasing influence over our sources of materials supply to try to manipulate our behavior on other issues than it would be if we had never let the nuclear genie out of the bottle.

Mr. GLICKMAN. Since you mentioned the statute, the stockpile is triggered on the basis of a military emergency. I don't think that the word "economic emergency," similar to the oil embargo of 1973, would trigger the stockpile. Do you think the statute needs to be changed as to what the stockpile could be extended to include, for what purpose?

Mr. SCHMITT. Mr. Chairman, I tend to think it should, but I think that has to be done very carefully. You have to, again, make absolutely sure that everybody knows what we are doing. The principal purpose must be for national defense. I think the framers of the act were wise in that respect.

But they could not have foreseen how a threat to our economy is, in a real sense, an indirect threat to our national security. So, again, on a commodity-by-commodity basis, I think an independent Stockpile Commission should be given the authority to evaluate the effect of a cut-off supply on our national economy as it would have major significance to national security. It is a very difficult subject to handle. But, again, if you have an independent commission, I think you can afford to make the stockpile an economic stockpile in part, because then it would be free of the manipulative aspects that, unfortunately, administrations and Congress get into.

I say free. It is never free of restraint. The Congress always has the legislative authority to move if they feel like the stockpile is abusive or acting improperly.

Mr. GLICKMAN. Of course, we have done that. We have created a stockpile in petroleum. We don't call it a stockpile, but in fact it is that.

Mr. SCHMITT. You have done that, and I think the legislative precedent is good, and Congress still keeps a watchful eye over that.

I, of course, have opposed the creation of the strategic stockpile of petroleum. I don't think you scare anybody with the ability to produce a million barrels a day for a few months. In a high-use commodity, strategic stockpiles are meaningless; in a low-use commodity, they are extraordinarily valuable. I think that is a very important distinction to draw here. In my mind, there are no technical analogies between the strategic stockpile in petroleum and the kind of stockpile that the chairman is concerned with now. There are some lessons to learn from that, however.

Mr. GLICKMAN. I have one last question. Do you have any position on title III funding of the Defense Industrial Base Revitalization Act? Secretary Weinberger has suggested using DOD moneys to fund title III. Do you think we would compromise our national security if we do not take action to preserve and rejuvenate our defense industrial base, which includes the minerals processing industry now deteriorating rapidly, due to the pressure of subsidized foreign suppliers?

Mr. SCHMITT. As I have indicated in my testimony and in my remarks, I think that title III must be used, and could be well used by a Strategic Stockpile Commission to provide alternatives to the stockpile or to insure that you have that warm or existing industrial base that can expand to take up in time where the stockpile leaves off if we, in fact, do lose for the foreseeable future access to some strategic commodity.

It is not just cobalt. We tend to get focuses on cobalt because everybody knows about it. But we are equally vulnerable in aluminum and titanium and chromite and any number of materials of this kind that are absolutely critical, not only to the functioning of our national security forces, but to our economy.

Mr. GLICKMAN. I think that is a critical point. The commercial aviation industry, which is the heart of the employment base in my district, is based upon the availability of these materials, notwithstanding their effect on the national defense as well.

Mr. SCHMITT. There will be some who oppose any urgent action, who will say that, if we have to, we can begin to use the low-grade clays that exist in the United States. I won't argue with that, except we don't know really how to use them right now. We don't have the processes or plants set up. The industrial base doesn't exist to begin to use those clays. If we see a situation where we have difficulty in obtaining bauxite supplies from Jamaica and other areas as a result of the deteriorating situation in the Caribbean and Central America, we are not in a position to produce our own aluminum. We might get there in 5 years, but what happens during that 5-year period when we don't have easy access to aluminum?

Again, every commodity has its own horror story, but they are very real horror stories, and it doesn't take much of an extrapolation of current events to see where those could result in one or more of these commodities being unavailable.

Mr. GLICKMAN. Senator, we thank you very much for your excellent testimony. After 3 or 4 days of testimony, we may in fact be making recommendations or developing our own legislation, and your views are extremely important in that context.

Mr. SCHMITT. If I can be of any further assistance, Mr. Chairman, you know that I am available to you.

Mr. GLICKMAN. Thank you very much.

We are going to have to quit for a few minutes while we go vote. We will be back in about 15 minutes.

[Recess.]

Mr. GLICKMAN. Our next witness is Louis Giuffrida, Director of FEMA.

I understand that you are in a time bind. Your entire statement will appear in the record therefore you may feel free to summarize if you wish, and then leave. Why don't you introduce the gentleman next to you in case you leave and we have additional questions. It is a pleasure to have you here today.

STATEMENT OF LOUIS O. GIUFFRIDA, DIRECTOR, FEDERAL EMERGENCY MANAGEMENT AGENCY, ACCOMPANIED BY PAUL K. KRUEGER, ASSISTANT ASSOCIATE DIRECTOR FOR RESOURCES PREPAREDNESS, FEDERAL EMERGENCY MANAGEMENT AGENCY

Mr. GIUFFRIDA. Thank you, Mr. Chairman.

I can make my statement in about 5 minutes and, with your indulgence, I will turn it over to Mr. Paul Krueger.

As indicated, I am the Director of FEMA. I am glad to have this opportunity to come up here and talk to the committee. I will comment specifically on our position on proposals to establish an independent stockpile management agency or to transfer the stockpile management to the Department of Defense.

FEMA has shown a determined awareness and taken positive actions with regard to America's position on strategic and critical materials. On March 31, 1981, President Reagan directed the start of a major purchase program for the National Defense Stockpile. These were the first truly significant acquisitions in over 20 years. Since that time, substantial additions of cobalt, bauxite, iridium, quinidine sulfate, and tantalum have been made to the stockpile inventory.

As to the character of the stockpile, the vast majority of stockpile materials were acquired at least 20 years ago. Concerns have arisen that some of these materials may not be usable in today's technology. Two pilot studies addressing these concerns have been initiated in response to provisions of the national materials and minerals program plan. For these studies, FEMA is serving as the lead agency. Strong support is being provided by the Departments of the Interior, Commerce, and Defense, and by the General Services Administration.

In late September 1982, FEMA awarded two contracts for the evaluation of National Defense Stockpile materials. One contract was awarded to the American Society for Metals [ASM] to assess the quality and form of cobalt now in the stockpile. A second contract was awarded to the National Materials Advisory Board, [NMAB] of the National Research Council to determine which, if any, of the other stockpile materials should have intensive quality assessments. These two assessments are being carried out by panels composed primarily of industry experts who will ultimately be the users of these materials. Currently, the ASM cobalt study is nearing completion, and the NMAB study has concluded phase I of the 2-part study. The results of these two studies will provide guidance for future actions on stockpile quality.

Additionally, FEMA prepared and published in 1982 an extensive study on cobalt evaluating alternative policies to stockpiling. The 2-year study addressed the economic and budgetary consequences of policies to reduce the effects of a supply disruption through the use of title III of the Defense Production Act of 1950.

The management and operations of the National Defense Stockpile is divided, as you know, between FEMA and GSA. FEMA is responsible for formulating stockpile policy, for determining the quantity and quality of materials to be held in the stockpile, and for reporting to Congress on the stockpile program. These activities

are conducted under authority delegated by the President in Executive Order 12155, and derive from sections 3, 5, and 11 of the Strategic and Critical Materials Stock Piling Act. GSA is responsible for the conduct of the property management functions and the acquisition and disposal operations for materials under authority similarly delegated by the President for section 6 of the Stock Piling Act. This arrangement has proved to be an effective and useful division of responsibility between the two agencies, each agency concentrating on those activities for which it is best equipped.

We are opposed to the suggestion that stockpile management should be moved to the Department of Defense. Under such an arrangement, the stockpile activities would primarily be focused on materials needed for direct and indirect Department of Defense requirements in the event of a national emergency. The stockpile, however, is mandated by Congress to serve a broader range of national security interests, supporting essential civilian and basic industrial production sectors in the event of a national emergency. In fact, about two-thirds of stockpile materials are required to meet wartime essential civilian and industrial needs, whereas only one-third of stockpile materials are allocated to Department of Defense requirements.

The original congressional intent for the effective conduct of the stockpile program requires that the activities of a number of agencies other than the Department of Defense must be coordinated. These agencies include the Departments of Commerce, State, Agriculture, Interior, and Treasury. FEMA, through its mission and structure, is uniquely qualified to assure the effective and appropriate coordination of the range of interagency interests required by this congressional mandate. For this reason, it is appropriate that FEMA, the civilian agency with the lead responsibility for emergency preparedness, act as overall coordinator of the National Defense Stockpile. The Department of Defense currently fully participates in the interagency group which makes the stockpile decisions to insure that defense needs are taken into account. Under the proposed arrangement, the independent review and certification authority available to the Director of FEMA of projects under title III of the Defense Production Act would be clouded.

We are also opposed to proposals to establish an independent stockpile management agency. The current stockpile organizational alinement is able to take into consideration the wide range of national security factors contributing to an effective stockpile program because of the existing integration of such factors over several programs. Consequently, such an independent agency is not needed, would not in our judgment provide any advantage over existing arrangements, and would tend to divorce the stockpile from emergency mobilization and other national security interests it serves.

Current administration policy is explicit in assigning responsibility for improving the Nation's preparedness capabilities to the Emergency Mobilization Preparedness Board. On April 5, 1982, the President forwarded a report to Congress. This report, as well as National Security Decision Director 47, which was signed by the President on July 22, 1982, makes it clear that preparedness policy

formulation is the responsibility of the Emergency Mobilization Preparedness Board. Review of stockpile policy by any other forum would circumvent established administrative procedures and directly counter Presidential policy. A sub-working group of the industrial mobilization working group of the board is currently reviewing stockpile policy in order to make recommendations to the board.

The national defense stockpile is only one element of the broader national security and mobilization programs of the United States. The management of the stockpile, as well as responsibilities assigned to FEMA under the Defense Production Act, are distinct elements of the integrated emergency management system which has been developed by this Administration to be responsive to national emergency conditions. To set off to the side one aspect—the stockpile program—would also compromise the effectiveness of the broader mobilization and national security objectives.

Mr. Chairman, that concludes my prepared statement. I thank you for permitting me to leave at this time. I will turn the chair over to Mr. Paul Krueger of my staff, who is the Assistant Associate Director for Resource Preparedness.

[The prepared statement of Mr. Guiffrida follows:]

STATEMENT OF THE HONORABLE LOUIS O. GIUFFRIDA

DIRECTOR

FEDERAL EMERGENCY MANAGEMENT AGENCY

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

MAY 18, 1983

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE, I AM LOUIS O. GIUFFRIDA, DIRECTOR OF THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA), AND I WELCOME THE OPPORTUNITY TO PRESENT THE VIEWS OF THIS AGENCY AND THE ADMINISTRATION REGARDING THE CHARACTER AND MANAGEMENT OF THE NATIONAL DEFENSE STOCKPILE OF STRATEGIC AND CRITICAL MATERIALS. I WILL ALSO COMMENT SPECIFICALLY ON OUR POSITION ON PROPOSALS TO ESTABLISH AN INDEPENDENT STOCKPILE MANAGEMENT AGENCY OR TO TRANSFER THE STOCKPILE MANAGEMENT TO THE DEPARTMENT OF DEFENSE.

FEMA HAS SHOWN A DETERMINED AWARENESS AND TAKEN POSITIVE ACTIONS WITH REGARD TO AMERICA'S POSITION ON STRATEGIC AND CRITICAL RAW MATERIALS. ON MARCH 13, 1981, PRESIDENT REAGAN DIRECTED THE START OF A MAJOR PURCHASE PROGRAM FOR THE NATIONAL DEFENSE STOCKPILE. THESE WERE THE FIRST SIGNIFICANT ACQUISITIONS IN OVER TWENTY YEARS. SINCE THAT TIME SUBSTANTIAL ADDITIONS OF COBALT, BAUXITE, IRIDIUM, QUINIDINE SULFATE, AND TANTALUM HAVE BEEN MADE TO THE STOCKPILE INVENTORY.

AS TO THE CHARACTER OF THE STOCKPILE, THE VAST MAJORITY OF STOCKPILE MATERIALS WERE ACQUIRED AT LEAST TWENTY YEARS AGO. CONCERNS HAVE ARISEN THAT SOME OF THESE MATERIALS MAY NOT BE USABLE IN TODAY'S TECHNOLOGY. TWO PILOT STUDIES ADDRESSING THESE CONCERNS HAVE BEEN INITIATED IN RESPONSE TO PROVISIONS

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OF THE NATIONAL MATERIALS AND MINERALS PROGRAM PLAN. FOR THESE STUDIES FEMA IS SERVING AS LEAD AGENCY. STRONG SUPPORT IS BEING PROVIDED BY THE DEPARTMENTS OF OF THE INTERIOR, COMMERCE, AND DEFENSE, AND BY THE GENERAL SERVICES ADMINISTRATION (GSA).

IN LATE SEPTEMBER, 1982, FEMA AWARDED TWO CONTRACTS FOR THE EVALUATION OF NATIONAL DEFENSE STOCKPILE MATERIALS. ONE CONTRACT WAS AWARDED TO THE AMERICAN SOCIETY FOR METALS (ASM) TO ASSESS THE QUALITY AND FORM OF COBALT NOW IN THE STOCKPILE. A SECOND CONTRACT WAS AWARDED TO THE NATIONAL MATERIALS ADVISORY BOARD (NMAB) OF THE NATIONAL RESEARCH COUNCIL TO DETERMINE WHICH, IF ANY, OF THE OTHER STOCKPILE MATERIALS SHOULD HAVE INTENSIVE QUALITY ASSESSMENTS. THESE TWO ASSESSMENTS ARE BEING CARRIED OUT BY PANELS COMPOSED PRIMARILY OF INDUSTRY EXPERTS WHO WILL ULTIMATELY BE THE USERS OF THESE MATERIALS. CURRENTLY, THE ASM COBALT STUDY IS NEARING COMPLETION AND THE NMAB STUDY HAS CONCLUDED PHASE I OF THE TWO-PART STUDY. THE RESULTS OF THESE TWO STUDIES WILL PROVIDE GUIDANCE FOR FUTURE ACTIONS ON STOCKPILE QUALITY.

ADDITIONALLY, FEMA PREPARED AND PUBLISHED IN 1982 AN EXTENSIVE STUDY ON COBALT EVALUATING ALTERNATIVE POLICIES TO STOCKPILING. THE TWO-YEAR STUDY ADDRESSED THE ECONOMIC AND BUDGETARY CONSEQUENCES OF POLICIES TO REDUCE THE EFFECTS OF A SUPPLY DISRUPTION THROUGH THE USE OF TITLE III OF THE DEFENSE PRODUCTION ACT OF 1950.

THE MANAGEMENT AND OPERATIONS OF THE NATIONAL DEFENSE STOCKPILE IS DIVIDED BETWEEN FEMA AND GSA. FEMA IS RESPONSIBLE FOR FORMULATING STOCKPILE POLICY, FOR DETERMINING THE QUANTITY AND QUALITY OF MATERIALS TO BE HELD IN THE STOCKPILE, AND FOR REPORTING TO CONGRESS ON THE STOCKPILE

PROGRAM. THESE ACTIVITIES ARE CONDUCTED UNDER AUTHORITY DELEGATED BY THE PRESIDENT IN EXECUTIVE ORDER 12155, AND DERIVE FROM SECTIONS 3, 5, AND 11 OF THE STRATEGIC AND CRITICAL MATERIALS STOCK PILING ACT. GSA IS RESPONSIBLE FOR THE CONDUCT OF THE PROPERTY MANAGEMENT FUNCTIONS AND THE ACQUISITION AND DISPOSAL OPERATIONS FOR STOCKPILE MATERIALS UNDER AUTHORITY SIMILARLY DELEGATED BY THE PRESIDENT FOR SECTION 6 OF THE STOCK PILING ACT. THIS ARRANGEMENT HAS PROVED TO BE AN EFFECTIVE AND USEFUL DIVISION OF RESPONSIBILITY BETWEEN THE TWO AGENCIES, EACH AGENCY CONCENTRATING ON THOSE ACTIVITIES FOR WHICH IT IS BEST EQUIPPED.

HOWEVER, THE POSSIBILITY OF IMPROVING THIS RELATIONSHIP IS ADDRESSED IN THE FORTHCOMING REPORT BY THE PRESIDENT'S PRIVATE SECTOR SURVEY ON COST CONTROL (GRACE COMMISSION). THE COMMISSION TASK FORCE FOR FEMA RECOMMENDED THAT CONTROL OF THE STOCKPILE TRANSACTION FUND BE TRANSFERRED TO FEMA TO MORE PROPERLY ALIGN AUTHORITY AND RESPONSIBILITY OF FUNCTIONS.

WE ARE OPPOSED TO THE SUGGESTION THAT STOCKPILE MANAGEMENT SHOULD BE MOVED TO THE DEPARTMENT OF DEFENSE. UNDER SUCH AN ARRANGEMENT THE STOCKPILE ACTIVITIES WOULD BE FOCUSED PRIMARILY ON MATERIALS NEEDED FOR DIRECT AND INDIRECT DEFENSE DEPARTMENT REQUIREMENTS IN THE EVENT OF A NATIONAL EMERGENCY. THE STOCKPILE, HOWEVER, IS MANDATED BY CONGRESS TO SERVE A BROADER RANGE OF NATIONAL SECURITY INTERESTS, SUPPORTING ESSENTIAL CIVILIAN AND BASIC INDUSTRIAL PRODUCTION SECTORS IN THE EVENT OF A NATIONAL EMERGENCY. IN FACT, ABOUT TWO-THIRDS OF STOCKPILE MATERIALS ARE REQUIRED TO MEET WARTIME ESSENTIAL CIVILIAN AND INDUSTRIAL NEEDS, WHEREAS ONLY ONE-THIRD OF STOCKPILE MATERIALS ARE ALLOCATED TO DEPARTMENT OF DEFENSE REQUIREMENTS.

THE ORIGINAL CONGRESSIONAL INTENT FOR THE EFFECTIVE CONDUCT OF THE STOCKPILE PROGRAM REQUIRES THAT THE ACTIVITIES OF A NUMBER OF AGENCIES OTHER THAN THE DEPARTMENT OF DEFENSE MUST BE COORDINATED. THESE AGENCIES INCLUDE THE DEPARTMENTS OF COMMERCE, STATE, AGRICULTURE, INTERIOR, AND TREASURY. FEMA, THROUGH ITS MISSION AND STRUCTURE, IS UNIQUELY QUALIFIED TO ASSURE THE EFFECTIVE AND APPROPRIATE COORDINATION OF THE RANGE OF INTERAGENCY INTERESTS REQUIRED BY THE CONGRESSIONAL MANDATE. FOR THIS REASON, IT IS APPROPRIATE THAT FEMA, THE CIVILIAN AGENCY WITH LEAD RESPONSIBILITY FOR EMERGENCY PREPAREDNESS, ACT AS OVERALL COORDINATOR OF THE NATIONAL DEFENSE STOCKPILE. THE DEPARTMENT OF DEFENSE CURRENTLY FULLY PARTICIPATES IN THE INTERAGENCY GROUP WHICH MAKES THE STOCKPILE DECISIONS TO INSURE THAT DEFENSE NEEDS ARE TAKEN INTO ACCOUNT. UNDER SUCH AN ARRANGEMENT, THE INDEPENDENT REVIEW AND CERTIFICATION AUTHORITY AVAILABLE TO THE DIRECTOR OF FEMA OF PROJECTS UNDER TITLE III OF THE DEFENSE PRODUCTION ACT WOULD BE CLOUDED.

WE ARE ALSO OPPOSED TO PROPOSALS TO ESTABLISH AN INDEPENDENT STOCKPILE MANAGEMENT AGENCY. THE CURRENT STOCKPILE ORGANIZATIONAL ALIGNMENT IS ABLE TO TAKE INTO CONSIDERATION THE WIDE RANGE OF NATIONAL SECURITY FACTORS CONTRIBUTING TO AN EFFECTIVE STOCKPILE PROGRAM BECAUSE OF THE EXISTING INTEGRATION OF SUCH FACTORS OVER SEVERAL PROGRAMS. CONSEQUENTLY, SUCH AN INDEPENDENT AGENCY IS NOT NEEDED, WOULD NOT PROVIDE ANY ADVANTAGE OVER EXISTING ARRANGEMENTS, AND WOULD TEND TO DIVORCE THE STOCKPILE FROM EMERGENCY MOBILIZATION AND OTHER NATIONAL SECURITY INTERESTS IT SERVES.

CURRENT ADMINISTRATION POLICY IS EXPLICIT IN ASSIGNING RESPONSIBILITY FOR IMPROVING THE NATION'S PREPAREDNESS CAPABILITIES TO THE EMERGENCY MOBILIZATION PREPAREDNESS BOARD. ON APRIL 5, 1982, THE PRESIDENT FORWARDED A REPORT TO CONGRESS. THIS REPORT AS WELL AS NATIONAL SECURITY DECISION

DIRECTIVE 47, WHICH WAS SIGNED BY THE PRESIDENT ON JULY 22, 1982, MAKES IT CLEAR THAT THE PREPAREDNESS POLICY FORMULATION IS THE RESPONSIBLITY OF THE EMERGENCY MOBILIZATION PREPAREDNESS BOARD. ANY OTHER FORUM REVIEW OF STOCKPILE POLICY WOULD CIRCUMVENT ESTABLISHED ADMINISTRATIVE PROCEDURES AND DIRECTLY COUNTER PRESIDENTIAL POLICY. A SUB-WORKING GROUP OF THE INDUSTRIAL MOBILIZATION WORKING GROUP OF THE BOARD IS CURRENTLY REVIEWING STOCKPILE POLICY IN ORDER TO MAKE RECOMMENDATIONS TO THE BOARD.

THE NATIONAL DEFENSE STOCKPILE IS ONLY ONE ELEMENT OF THE BROADER NATIONAL SECURITY AND MOBILIZATION PROGRAMS OF THE UNITED STATES. THE MANAGEMENT OF THE STOCKPILE, AS WELL AS RESPONSIBILITIES ASSIGNED TO FEMA UNDER THE DEFENSE PRODUCTION ACT, ARE DISTINCT ELEMENTS OF THE "INTEGRATED EMERGENCY MANAGEMENT SYSTEM" (IEMS), WHICH HAS BEEN DEVELOPED BY FEMA TO BE RESPONSIVE TO NATIONAL EMERGENCY CONDITIONS. TO SET OFF TO THE SIDE ONE ASPECT--THE STOCKPILE PROGRAM--WOULD ALSO COMPROMISE THE EFFECTIVENESS OF THE BROADER MOBILIZATION AND NATIONAL SECURITY OBJECTIVES.

MR. CHAIRMAN, THAT CONCLUDES MY PREPARED STATEMENT. ACCOMPANYING ME THIS MORNING IS MR. PAUL K. KRUEGER, WHO IS ASSISTANT ASSOCIATE DIRECTOR FOR RESOURCES PREPAREDNESS. EITHER OF US WOULD BE HAPPY TO REPOND TO YOUR QUESTIONS.

Mr. GLICKMAN. Thank you very much, Mr. Giuffrida. We appreciate your being here.

Mr. GIUFFRIDA. Thank you, sir.

Mr. GLICKMAN. Mr. Krueger, let me ask you the first question. By what mechanism does FEMA establish stockpile priorities and specifications? What involvement does industry and the private sector have in that process? How does FEMA respond to changes in stockpiled materials quality?

I have asked you three questions there. The first point is how do you decide what gets priority in terms of what goes into the stockpile?

Mr. KRUEGER. When we do the calculations to determine how much of each of the materials should be in the stockpile, we look at this over three different sectors of the economy, the defense sector, an essential civilian sector, and a basic industrial sector.

In addition to that, we also look at the requirements over 3 years. So by looking at the individual pieces of the stockpile—that is, year by year, as well as sector by sector—fairly logical priorities for acquisitions can be established. For instance, you would want to be sure you had the first year requirements for the military in your stockpile before you became concerned with the third year requirements for basic industrial. So there is a natural order to this.

In addition, we funded a study that started last November and was concluded in January to look at this in particular, where there were materials that had a synergistic effect—that is, that were used together. If you didn't have a balanced program of acquisitions, then the materials already in hand would not be usable because you didn't have the complementary materials necessary to use with them. This is true especially of the high technology materials that go into sophisticated weapons systems and the sophisticated technology that is becoming quite commonplace in American business and industry.

I will just cite the case of cobalt. I think everyone knows that cobalt is very essential to the manufacture of engines for jet aircraft, both military and civilian. But, unless you also have tantalum and chromium and titanium, all the cobalt in the world will not let you build jet engines. So we set up balanced priorities.

I think your second question was concerned with the quality and how did industry participate.

Mr. GLICKMAN. Let me interrupt you for a minute. There is some concern that the cobalt you have in the stockpile hasn't been rotated in its 30-year life and wouldn't even be useful due to purity problems if we had to use it. How do you feel about that?

Mr. KRUEGER. There are 45 million pounds of cobalt in the stockpile. We would like to have 85 million pounds. Forty million pounds were purchased some years ago; five million pounds were purchased more recently. We are aware of those concerns, and FEMA funded a study with the American Society for Metals to determine how adequate is the existing cobalt in the stockpile. That study has not been completed, but the results of the first phase of that study indicate that all of the cobalt in the stockpile would be usable for ordinary applications. Much of the cobalt in the stockpile couldn't be used for the most demanding applications, so we

would probably not want to use the 40 million pounds for jet aircraft engines.

On the other hand, there is the 5 million pounds we have recently purchased which is of the highest quality. Any additional purchases we make of cobalt will continue to be of the highest quality to bring the inventory into balance.

Mr. GLICKMAN. I am still concerned about the industry component to all of this. My feeling is that just maybe a private stockpile would represent a useful supplement to the current stockpile, because I think industry is going to be a lot more sensitive to issues like purity and quality of the materials being stockpiled. I wonder if you would comment on that.

Mr. KRUEGER. The people who make alloys for the aircraft industry might in fact stockpile the higher-quality cobalt, but cobalt is used in a lot of other applications. The industrial people who manufacture items containing cobalt for these other applications, if they were to stockpile cobalt, would stockpile cobalt very much like that already in the stockpile.

Mr. GLICKMAN. Do you have the statutory authority to stockpile anything that is deemed relevant for national security purposes? Are there limitations in the statute to what you can stockpile?

Mr. KRUEGER. The legislative history would indicate the intent is to stockpile basic materials rather than manufactured goods.

Mr. GLICKMAN. You mean minerals. You are not stockpiling materials, are you? You are stockpiling minerals.

Mr. KRUEGER. We are also stockpiling some agricultural raw materials and some pharmaceutical raw materials.

Mr. GLICKMAN. So some processed items are stockpiled?

Mr. KRUEGER. Yes. In the minerals area, we, for instance, stockpile a number of ferroalloys.

Mr. GLICKMAN. What agricultural products are stockpiled?

Mr. KRUEGER. Quinidine sulfate, quinine, and some vegetable tannins. There are still carried on the list some other agricultural products for which we do not have current inventories: Abaca and sisal, which are cordage fibers, and pyrethrum, which is an insecticide.

Mr. GLICKMAN. My understanding is that the stockpile deficiency amounts to something on the order of $12 billion, while surplus stockpile materials like tin, tungsten, diamond stones, and silver represent roughly $5 billion in potential proceeds available to the stockpile transaction fund. Why is FEMA then requesting only $120 million for the stockpile?

Mr. KRUEGER. FEMA, technically, is not making that request; it is in GSA's budget. While there is that much excess material available, you have to be able to sell the materials to generate revenues to make offsetting purchases. At this point in time, while there is in fact, as you suggest, $5 billion worth of excess materials, in terms of money we have in the fund, it is closer to $200 million.

Mr. GLICKMAN. Is that fund in the general fund of the Treasury?

Mr. KRUEGER. No. It is a special fund established in 1979 for this purpose. Proceeds from the sale of materials go into the fund, and appropriations for acquisition of materials come from the fund.

Mr. GLICKMAN. For the purpose of U.S. budgeting requirements, is it budgeted as if sales were revenues of the Government of the United States in the aggregate?

Let me give you an example, the Airport-Airways Trust Fund, even though it is a separate fund, it still reflects in the revenues and expenditures side of the budget, therefore if you don't spend the money, even though it is in a trust fund, it looks like you are spending less in the Government. Is that also true with this fund?

Mr. KRUEGER. It is similar to that. The issue is a little clouded because, for fiscal year 1983, the committees involved here, instead of making an appropriation, granted contract authority. If it continues as contract authority rather than appropriations, then, in effect, it would an off-budget fund. Fiscal year 1983 is the first year that has happened, though.

Mr. GLICKMAN. I am still worried about a lack of commitment on the fact that you or GSA is requesting only $120 million. That seems to at least give me the implication that you are not very serious in some of these areas.

Mr. KRUEGER. I think it is a good start. You are correct that the problem is large, and we are going to have to move out in the future at a faster pace than we are at the moment.

Mr. GLICKMAN. It is a 1 percent start, $120 million over $12 billion. I am just wondering if folks like David Stockman and others have asked you to reduce your stockpile purchases because of budget problems.

Mr. KRUEGER. If you look over the last 5 years, various administrations have requested $800 million in appropriations. At this point in time, Congress has appropriated less than $300 million. In every case, and for a number of years, we went up with about a $200 million appropriations request, and Congress appropriated zero. The year before last, the administration asked for $120 million, and we ended up with $57.6 million. Last year, when the Congress moved it off budget to contract authority, the full request was granted.

Mr. GLICKMAN. How much is FEMA requesting for civil defense this year?

Mr. KRUEGER. $250 million.

Mr. GLICKMAN. I am not sure if you can relate the two items. How does that relate to what you requested last year, fiscal year 1983?

Mr. KRUEGER. We requested the same. Congress appropriated around $150 million for civil defense last year. The House Authorization Committee has marked down the $250 million request to $200 million this year.

Mr. GLICKMAN. Do you have any experience with stockpiling activities in other nations? How do they compare structurally and institutionally to what we do in this country?

Mr. KRUEGER. The United States by far has the largest stockpile. It also has the longest continuous history of stockpiling.

There are active stockpile programs in Finland, Sweden, Switzerland, and the United Kingdom. There is a dormant stockpile program in Norway. The Japanese, the West Germans, and the Taiwanese are actively considering stockpiling programs. There is a small stockpile program in Korea.

There are also stockpile programs in the Soviet Union. These are considered to be state secrets by the Soviet Union, and very little is known about them.

All of the stockpile programs I have mentioned are what I will call national security programs. They are not necessarily wartime programs, but they are definitely non-economic. In some cases, Korea and Sweden, the programs also cover items like cement, plastic, lumber, materials that these countries might not receive. Most of these programs have goals and philosophies of stockpiling to cover 2 months, 3 months, perhaps 6 months. The U.S. stockpile of 3 years is much more ambitious.

Mr. GLICKMAN. OK. We thank you, Mr. Krueger, for testifying today. We appreciate it.

Mr. KRUEGER. Thank you.

Mr. GLICKMAN. I do want to recognize a distinguished gentleman in the audience, the Ambassador from the country of Zaire. I am going to try your name, Mr. H. E. Kasongo Mutuale.

Mr. KASONGO MUTUALE. Yes.

Mr. GLICKMAN. It is a pleasure to have you here, Mr. Ambassador. We are very appreciative that you are with us. We know of the significance and importance of Zaire and your nation's minerals and materials to the United States.

Mr. GLICKMAN. Our next witness is Mr. Roy Markon, with Jay Solomon Associates. Roy use to be with the GSA and, in fact, had some dealings in my part of the country. It is a pleasure to have you here, Roy. We are appreciative that you are here to testify.

As I have said to the other witnesses, your entire statement will appear in the record, so you may feel free to summarize if you wish.

STATEMENT OF ROY MARKON, JAY SOLOMON ASSOCIATES

Mr. MARKON. Thank you, Mr. Chairman. I am very pleased to be here.

I will summarize and supplement the remarks in my statement.

Mr. Jay Solomon is my business partner. In the period 1977 through 1979, he served as the Administrator of GSA, at which time the stockpile policy, as well as the management or buying and selling activities, were under his direction.

My statement contains a historical summary of the stockpile as managed over a period of years beginning with 1939. That was the year of the first act that authorized stockpile. That act provided for a defense stockpile to be managed by the Army-Navy Munitions Board, with assistance from the Department of the Interior. This lasted only a year because, at that time, Hitler was on the move in Europe and the Nation's mobilization requirements were a lot greater than just the stockpile, and the RFC and its subsidiary corporations took over.

After the war, some materials that were excess to the military requirements got into the stockpile under the Surplus Property Act of 1944. The 1946 Stockpiling Act directed that the program be managed by the Army-Navy Munitions Board with assistance by the various departments of Government, principally the Depart-

ment of the Interior. This principle was continued in the present act, which is the 1979 act.

In addition to the purchases by direct appropriations under the various Stockpiling Acts, the stockpile was supplemented by materials that came from the Marshall plan, from the Defense Production Act, and from the Surplus Property Act.

A lot of the materials that came into the stockpile were not in the best shape, particularly those materials that were acquired under the Defense Production Act. That is one of the reasons why we have in the stockpile today some suspect materials. Also, as Mr. Krueger just testified, there are technological changes. What was once adequate for our defense purposes is now changed because of technological developments.

My experience in the stockpile goes back to 1978, when I was made the Commissioner of FPRS. This organization move was Mr. Solomon's attempt to centralize the stockpile functions within GSA.

In the history of the buying, selling, and management activities of the stockpile, there were not so many realinements between agencies of the Government. When the stockpile first was originated in 1939, the responsibility to buy, sell, and manage the stockpile was with the Department of the Treasury, Procurement Division. In 1949, when GSA was created, this responsibility shifted to GSA, and it is still with GSA today. However, within GSA, there were various changes between services and component parts of GSA. So the management was in one agency that made several internal changes.

The stockpile has more than a defense value. There will always be incidental benefits to other interests in the stockpile decisions and activities, or lack of activities. So long as these benefits remain incidental and the defense interests are paramount, we will have a stockpile as intended by the various acts of Congress.

As currently organized, the stockpile program has no single sponsor. While the program is for defense purposes, the policy and goal setting is with a civilian agency, FEMA. The Acting Associate Administrator of FEMA responsible for the stockpiling program testified before Mr. Bennett in February of this year that only 5 percent of his time was devoted to stockpile matters. This is not unusual. Although the various agencies and departments of the Government have responsibilities in the stockpile, these responsibilities are exercised at a much lower level than the Office of the Secretary or Assistant Secretary.

During my management of the stockpile, I had difficulties because of this. My requests for funds were subordinated to other requirements of the Administrator. The Administrator's priorities preceded my priorities, and the stockpile acquisition request was used not only by the OMB and by Congress to assist in budgetary matters, but also by the various Administrators of the program.

As Mr. Krueger indicated, there have been requests for over $800 million which generated basically from my activity. But when the appropriations requests went through the budget process, the requests for funds were greatly reduced. One year it was reduced from a request of $170 million, approximately, down to $58 million. That was done first by the Administrator of GSA to reduce the

$170 million to $147 million, then by the House Appropriations Committee to reduce it to $100 million, and then by the Senate to reduce it to $57 million, and the House/Senate compromise ended up with $58 million as the final result.

I testified in support of Mr. Bennett's bill to move the stockpile to the Department of Defense. This is not inconsistent with what the first witness said today. Jack Schmitt testified in favor of a commission. I think the difference between the two positions is more in the definition of what a stockpile is rather than how it should be managed. If you are going to have purely a defense stockpile for defense materials needs and indirect defense materials needs, then it should be defense program situated within the Department of Defense where it can compete with other defense programs.

What Mr. Schmitt and some of the other bills are proposing is a much broader stockpile where defense would be an integral or an associated compatible part of the total. I think that, under those circumstances, then it should not be a defense program. But the law today, the present Stockpiling Act, provides that this program shall be used for defense purposes only. Since the act is very specific as to its purpose, I believe that the program should be in the Department of Defense.

As stockpile manager, I have had the experience in other material and mineral issues. I was a member of COMAT under President Carter's administration, and then I attended a few meetings of COMAT under this administration. I also worked on the Cabinet Council working groups on mineral issues.

I believe that the country needs a stockpile. All of the studies that I have read over the years convinced me of this. The logic for this opinion is very simple and basic. The United States is not self-sufficient in commodities or supplies or materials that are critical to our defense needs. People who indirectly or directly continue to indefinitely postpone this requirement, I believe, are exposing this Nation to a very costly and dangerous risk.

My principal concern over the present management of the stockpile is on funding, not only the inadequacy of the request, but the inadequacy of sales receipts. This year's sales receipts may be less than one-half of the appropriation request. In a year or two, the T Fund will run out of money, so GSA won't have a basis to make a larger request.

As Mr. Krueger testified, there are currently approximately $200 million—I think the figure is more like $150 million—in the Transaction Fund. A $120 million appropriation request will leave $30 million. This is not a basis upon which to increase the appropriation request for next year.

I have made suggestions to improve this situation in the Armed Services Committee hearing in February of this year, and I have repeated those suggestions in my statement—basically to go back to recycling. Take all of the excess Government materials that are sold, some of which is scrap that contains the various minerals and elements that we need in the stockpile, and take the proceeds from such sales and, either through tolling or through repurchase, by the materials in the forms that we need.

Mr. Chairman, I will be pleased at this time to respond to any of your questions.

[The prepared statement of Mr. Markon follows:]

STATEMENT OF

ROY MARKON, ESQ.

GENERAL PARTNER

JAY SOLOMON, ASSOCIATES

Mr. Chairman, Members of the Subcommittee, Good morning. I am pleased to be here to give you my views and opinions regarding the operation and management of the National Defense Stockpile of Strategic and Critical Materials.

This is my first appearance before this Subcommittee, so permit me to introduce myself. I am Roy Markon, a general partner in Jay Solomon Associates, a consulting firm specializing in real property and strategic materials. My partner, Jay Solomon served as the Administrator of the General Services Administration (GSA) during the period of the debates and final enactment of the Strategic and Critical Materials Stockpiling Act of 1979 (PL 96-41, 50 USC 98 et seq.). At that time both stockpile policy and operations were conducted by GSA through the Federal Preparedness Agency (FPA) amd the Federal Supply Service (FSS), under the direction of the Administrator. The FPA was disolved in 1979 with the transfer of the functions of Stockpile policy or goal setting and coordination to the Federal Emergency Management Agency (FEMA).

Prior to the establishment of FEMA, the Administrator of GSA separated the goal setting and management functions by creating a separate Service to manage the Stockpile and the real and personal property programs. This Service was called the Fereral Property Resources Service (FPRS). FPRS was assigned the program responsibility for Stockpile Transactions (sales, purchases, inventory and reports), Stockpile Management, (storage, inspections, shipping and receiving) and excess federal real and personal property disposal. I was the Commissioner of FPRS from its inception in July of 1978 until July of last year when I retired from the federal civil service.

A stockpile is a supply of material stored for use in time of need or emergency. Historically it probably safe to say that the concept of stockpiling for contingencies is as old as civilization itself. Assurance and storage of supplies of war materials for defense has been a concern of the government since it came into existance more than 200 years ago.

The National Defense Stockpile of Strategic and critical materials was initiated in 1939 with the Strategic War Materials Act (PL 76-117). This Act authorized the Secretaries of War and Navy, acting jointly with the Department of Interior, through the Army-Navy Munitions Board (ANMB) to build a stockpile of strategic raw materials "in view of the threat or loss of imports as a result of the Japanese Conquests in Asia and the possible war in Europe." The Act became virtually inoperative by the summer of 1940 when it was superseded by broader and more urgent mobilization programs in preparation for World War II, and very little material was accumulated during its year of operation. From a program point of view, the Act provided for a defense stockpile to be managed by the Army and Navy with cooperation and assistance from the Department of Interior. This management and program concept of a defense managed program with Interior Department support was continued in the forerunner of the present Act - which was the Strategic and Critical Materials Stockpileing Act of 1946 (PL 79-520).

The 1946 Stockpile Act sets forth a policy to "decrease and prevent whenever possible a dangerous and costly dependence of the United States upon foreign nations for supplies of these (critical) materials in times of

national emergency." The Act authorized the Secretaries of War and Navy and the Secretary of Interior to determine which materials were strategic and critical and designated the Secretaries of State, Treasury, Agriculture and Commerce to cooperate with the Army and Navy in this regard. The Secretary of Interior was also authorized to make scientific and technical investigations of minerals which were determined to be essential to the common defense or industrial needs of the United States.

The Act further stated that the Army-Navy Munitions Board would act for the Secretary of War and Navy and would continue to set the policy and goals for the program in conjunction with the Department of Interior. Actual purchases of the stockpile commodities were to be made by the Department of Treasury Procurement Division which was also responsible for the storage and maintenance of the stockpiled commodities. The functions of the Treasury Department were transferred to the Administrator of GSA in 1949 with the creation of GSA.

In 1947, the National Security Act established the Department of Defense (DOD), the Central Intelligence Agency (CIA), the National Security Council (NSC) and the National Security Resources Board (NSRB). The NSRB was to advise the President on military, industrial and civilian mobilization, including critical materials policy, potential supplies and resources. Over the following 25 years, national planning for civil defense and other emergencies went through numerous organizational and name changes, directed or resulting from more than 24 Acts of Congress and Executive Orders, but the critical materials policy function remained as a part of the Executive Office of the President.

The apparant conflict in the administration of the stockpile policy between the Munitions Board and the creation of the NSRB was decided in favor of the Munitions Board in 1947. This position was slowly eroded and in 1954 the responsibility for stockpile policy was assumed by the Office of Defense Mobilization (ODM), and for the first time the Department of Defense had no management responsibilities in this essential defense program.

Under President Nixon's reorganization plan of 1973, major responsibilities for national preparedness were transferred from the Executive Office of the President to GSA. The Office of Emergency Planning's (successor to ODM), functions relating to stockpile policy were transferred intact to GSA which discharged its responsibilities for the Stockpile program through the FPA and the FSS until 1978.

The Materials that comprise the present inventory of the stockpile came into the program from several sources. The Surplus Property Act of 1944 provided for the transfer of excess materials from any Department of Government without reimbursement. The huge stocks of materials accumulated during World War II were released or sold to industry for civilian use but some were transferred to the stockpile. The materials acquired under the 1939 Stockpile Act and by appropriations under the 1946 Stockpile Act constitutes a large portion of the present stockpile. Materials were also acquired with counterpart funds under the Economic Cooperation Act or the Marshall Plan and through Agriculture Barter of surplus agriculture products by the Commodity Credit Corporation authorized by several Acts of Congress. The Defense Production Act of 1950 also contributed substantially to the stockpile inventory.

An organizational chart or trace of the policy setting responsibilities of the stockpile program through most of its history would resemble a schematic diagram of a complex weapons systems. A Congressional Joint Committee on Foreign Economic Cooperation in 1949 counted 16 executive agencies and 11 Congressional Committees involved in the stockpile process. Since 1949 these numbers have increased and several International Committees were added. Regardless of the actual numbers of agencies or organizations involved in the stockpile program, the fact remained that throughout the history of the program the organization for the policy setting was highly decentralized and dispersed.

There is a reason for this, Mr. Chairman. The stockpile program, while essentially a defense program, involves policies and requires technical assistance or expertise that is found only in the other various departments or agencies of the government. The determination of stockpile policy cannot fit neatly into any single administrative slot. It involves activities, responsibilities and interest of so many different departments and agencies that it is by necessity a cooperative affair. The dispersal of these responsibilities makes the program more difficult but not impossible to manage.

The one constant theme that is interwoven into the stockpile history is that the defense aspect or interest has been paramount. Indeed, the critisisms of the management can be directly tied to the effort of other interest who have, with considerable success, used the program to stabilize prices or as an aid in balancing the budget. These efforts succeeded not on arguments as to their merits in an economic sense but were often disguised as defense issues.

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We must recognize that the stockpile program has more than merely a defense value despite its creation and maintenance as a defense program. There will always be incidental benefits to other interest in stockpile decisions and activity or lack of activity. So long as these benefits remain incidental and the defense interest paramount, we will have a stockpile as intended by the various Acts of Congress that authorized the program.

The autonomous character of the stockpile program is another interesting aspect. The stockpile program as it is currently structured has no single sponsor. While the program is for defense purposes, policy and goal setting is assigned to a branch of FEMA and the appropriations and program execution is a responsiblity of GSA. The Acting Associate Administrator of FEMA responsible for stockpile program within FEMA testified that only 5% of his time is devoted to stockpile matters. The Department of Defense's and other agencies' participation in this program is through membership on several inter-agency committees with middle level managers. Within each of the participating agencies the national defense stockpile is considered as an important but relatively minor program.

During my management of the Stockpile in GSA the position of Assistant Commissioner remained vacant over two years because of the Administrator's concerns, priorities and preoccupation in correcting the mismanagement of the Federal Supply Service. My request for funds was subordinated to the administrative requirements of the Administrator. The inspector general's office, office of general counsel, and the office of contract policy were unbelievable road blocks to progress. These offices were preoccupied with other priorities

of the Administrator and a committment to support and further the stockpile objectives was low on their individual agendas. In the GSA priority rankings of its annual budget, the stockpile program is at the bottom.

The present structure is seriously lacking in a strong committment of a well defined national defense interest. All of my studies and experience in defense planning lead me to believe that this nation needs a defense stockpile. The logic for this opinion rests on the fundamental and simple fact that the United States is not self-sufficient in commodities or supplies of materials that are critical to our defense needs. The people who directly or indirectly continue to indefinately postpone this requirement are exposing the nation to a costly and dangerous risk.

I testified before the Seapower and Strategic Stockpile Subcommittee of the House Armed Services Committee on February 22, 1983 in favor of HR33, a bill to transfer the management of the national defense stockpile to the Department of Defense. My testimony expressed my concern with the management of the program and contained recommendations for improvements. The one item that concerns me most is the question of adequate funding for stockpile purchases. While GSA has requested $120 million for FY 84 the receipts from sales in FY 83 that will support the expenditure will be approximately one half of that amount. In addition to the inadequate budget request, the lack of revenues from sales of excess commodities will severly impact the program. The office of Management and Budget unsupported sales projection that create the illusion of reducing the budget deficit must be exposed for what it is and some alternate funding in addition to increased sales is necessary.

There are millions of dollars of revenues being generated each year through the sale of defense property, both real and personal. In many of the sales of scrap metal by the Department of Defense the scrap contains significant amounts of metal that should be stockpiled. To toll this scrap or to utilize the proceeds from its sale to purchase materials to stockpile specifications is consistantwith sound management practice. The conversion of an asset to a desired form, whether in tolling or through sale and purchase, is simply recycling. The same can be said for defense owned real property particularly the sale of the defense industrial plants machinery and equipment.

The income from recycling or converting DOD property assets will generate about $300 to $400 million each year but this is not enough. The sales of the excess commodities in the stockpile must also be increased. The annual objective for the sale of excess Tin is 10,000 metric tons. This year's sales will be approximately 10% to 12% of that objective. Surely the defense needs of this nation far outweigh the inconvenience the International Tin Council Buffer Stock Manager's attempts to support the price of tin at its present high levels.

I believe that with a proper structure, the management of the stockpile program by the Department of Defense will emphasize the defense aspect and serve to shelter the program from non defense interests. I recognize that competition for the defense dollar within the DOD is an important consideration and the program may not rise higher in budget priorities. The trade-offs and priorities for all the defense programs should be made within the Department and reviewed by the same Congressional Committees that oversee other defense programs.

In the present organization the stockpile budget competes with non related administrative requirements for general government purposes. Getting back to basics, in this case returning a defense program to the defense department may not be the solution to all the problems but it will help.

Because of my responsibilities as the national defense stockpile manager and my work with strategic and critical materials I was requested or nominated to serve on several high level Committees and working groups within the government. The Committee on Materials or (COMAT) was established by the Federal Co-ordinating Council for Science, Engineering and Technology (FCCSET) which was created in 1977 by law (42 USC 6651). FCCSET operates as a part of the Executive Office of the President under the Chairmanship of the Director of the Office of Science and Technology Policy. I have also served as a member of several working groups of the Sub Cabinet Council on National Resources and Environment.

COMAT and the Sub Cabinet were to review national needs for materials in areas of research and development; assess the effectiveness and adequacy of Federal efforts to meet these national needs and coordinate and facilitate the planning and implementation of material-related activities among Federal Agencies. COMAT organized a working group under the Chairmanship of the representative from the Bureau of Standards to prepare a response or report to the Congress required by the National Materials and Mineral Policy, Research and Development Act of 1980. The responsibility for the final report was assumed by the Sub Cabinet Council and the report was submitted to the Congress in April of 1982.

The President's report contains a lot of fine policy statements and endorsements of existing programs. It supports the National Defense Stockpile program and advocates a balanced program of acquisition and disposal. It supported continuation of the Defense Production Act particulary titles I and III. It reaffirmed the necessity for COMAT to coordinate the federal materials and minerals research and development activities. Unfortunately, the report is not a program budget decision and the Office of Management and Budget does not accept the report as establishing any budget priorities.

There is no doubt that the issues of critical materials in both the defense and economic sense are recognized by all agencies of the government. What is lacking in this area is not another study or declaration of policy. A strong committment that is reflected in program results and budget priorities is the missing essential ingredient. While the DOD has advocated both the stockpile and DPA it has been reluctant to assume funding responsibility for the programs. The FY 84 request for $200 million for Title III proposed by DOD was presented to Congress as a blank check. It will be very interesting to see how the DOD will apply the funds to our long range industrial needs if Congress will appropriate the funds in spite of the weak and poorly presented justification. It does seem odd that DOD is requesting funds to enhance our industrial base but is opposed to funding the defense stockpile.

Congressman Charles Bennett, Chairman of the Sea Power and Strategic Stockpile Sub Committee of the House Armed Services Committee has continually

referred to the lack of will or desire by the administration's leaders as the basis for the lack of results. I agree with Mr. Bennett. Without some positive action I am afraid that the stockpile and minerals policy implementation will flounder or move at a pace that is wholly inadequate for our security needs as a nation.

Mr. Chairman, this concludes my statement. I will be pleased, at this time, to respond to any questions the Sub Committee may care to ask.

Thank you for your time and attention.

Mr. GLICKMAN. Thank you very much, Mr. Markon. As I summarize your testimony, you indicate that the current organizational structure of the stockpile is not satisfactory. You relate that from your personal experience. You indicate at least some support for the Department of Defense to manage the stockpile. I have got some concern that, if that were the case, there would be a conflict of deciding between defense needs or essential civilian or industrial needs with respect to certain circumstances that could develop, because the items being stockpiled have dual use. How do you resolve that?

Mr. MARKON. Go back to the definition of a stockpile. If it is a defense stockpile for defense puposes only, then I say it ought to be part of defense. But if you are going to broaden that—such as how far are you going to go with essential civilian—is this going to be more than just indirect defense, or are you going to go so far, as Senator Schmitt had testified, that you would also use the stockpile for economic purposes, or economic warfare, or resource warfare. If it is a defense program only—that is again getting back to the definition, then I think it ought to be a defense managed program—but if it going to be broader, then I agree it should not be.

Mr. GLICKMAN. The problem is that we may not be able to articulate a precise definition, as the world changes rather dramatically. For example, let's say, in the aviation industry stockpiled minerals that relate to both commercial and national defense purposes, but the minerals are so acutely related in the national defense, they probably ought to be in the defense stockpile. But they are also acutely related to the civilian aerospace industry. If you give the DOD total control, those are the kinds of problems that might develop, even if you are trying to make it a national defense stockpile.

Mr. MARKON. The materials, would only be released in the event of a defense emergency. They would not be released to the civilian sector because of the world price situation and cartels, and so on.

Mr. GLICKMAN. Not unless you were able to expand it.

Mr. MARKON. I have personally no objection to an expanded concept of the stockpile. I think it is very timely for the Congress to consider this. I have spoken to Mr. Bennett several times on this issue, and he also agrees. But he refers to the present act, and he

says that the act says defense purposes only. That is the basis of, I believe, his bill and my support of his bill.

Mr. GLICKMAN. You are very critical of budget requests. You indicate, and I quote from your statement, "While GSA had requested $120 million for fiscal year 1984, the receipts from sales in fiscal year 1983 that will support the expenditure will be approximately half of that amount." As I indicated to the previous witness from FEMA, the stockpile deficiency amounts to something on the order of $12 billion, while surplus stockpile materials represent roughly $5 billion in potential proceeds available to the Stockpile Transaction Fund. Why is this happening. From your perspective?

Mr. MARKON. The operation of the sales program is subject to so many outside forces. I think one of the principles that Senator Schmitt had incorporated in his proposal is to give the Commission the authority to operate outside of this goldfish bowl, to let them operate more like a buffer stock manager where they can buy, sell, enter into long-term contracts and engage in transactions on the various commodity exchanges.

It is very difficult to sell. Yesterday, the American Metal Market reported that the Minister from Bolivia appeared in New York and made a speech on mining. He criticized GSA and said that the GSA sales of tin is responsible for closing the tin mines in Bolivia. The GSA sales were only 1,000 metric tons so far this year. I think it is patently ridiculous to say that that has that kind of international effect.

I believe that, in today's market, it is possible for GSA to sell from 8,000 to 10,000 metric tons of tin a year without unduly disrupting the market, and they ought to be doing so. If they should, they will get the added revenues, and the revenues will support an increased appropriations request.

Mr. GLICKMAN. Do you consider private stockpiling a useful supplement to the current public stockpiles, or do you think private stockpiling is happening anyway?

Mr. MARKON. In some sense, you have that anyway. I think the situation that Senator Schmitt described with Noranda—here you have a mineral deposit that is uneconomical. There has been a lot of encouragement by the Government to have these corporations continue to maintain this facility so that it can be reopened and start producing when needed, but there is no financial support. So, in a sense, we are passing off to certain segments of the society the responsibility to make unusual contributions to the defense of the Nation. I think the cost of this should be spread over the whole country and everyone should pay their share. Through title III activities, you accomplish this.

Mr. GLICKMAN. I have one final question. You expressed concern in your statement that the Department of Defense is requesting funds in their fiscal year 1984 budget request for title III of the Defense Production Act to enhance our industrial base, but is opposed to funding the stockpile, even though you state that DOD advocates both the stockpile and the DPA. I am not sure I understand your concern in that area. I wonder if you might comment on that.

Mr. MARKON. It goes back again to the definition. Here is the stockpile that is, by law, a defense program and it is being funded by GSA where it is in a budget competing with administrative re-

quirements for purchase of chairs, and furniture, and all sorts of things. The industrial base has more than a defense aspect. I think that in this area you have heard from the Department of Commerce that a sound industrial base is not only necessary for defense, but also for our economy.

It would seem to me just more logical for Defense to fund the stockpile program because it is essentially theirs, and to have the Commerce Department or some other civilian department of the Government administer the money that is used for our industrial base, not necessary defense base, but industrial base.

Mr. GLICKMAN. Actually, the Banking Committee authorizes the Defense Production Act. We appreciate very much your testimony today. It is useful to the committee.

Before you leave, let me get to the jurisdiction within this committee which relates to materials R&D. I wonder if you could comment since this relates to the role of Government in providing substitutes for the minerals that are stockpiled. I don't know whether you have had much experience in that area or not.

Mr. MARKON. I heard the witnesses yesterday, and I have heard the ones this morning, and I think there is a reluctance on the part of the Government people to come forth. As you know, all of their statements are reviewed by OMB and they sing the same song.

I think if you got to some of those people individually and asked for their personal opinions, they would tell you yes, Government has a role. That the costs are tremendous, and the benefits are not necessarily directed to a particular corporation, company, or industry. The benefits inure to the Nation as a whole. So, therefore, there should be some national participation in the projects and costs. I agree with that.

Mr. GLICKMAN. Thank you very much, Mr. Markon.

Mr. MARKON. I might add one other thing on the budget.

Mr. GLICKMAN. Of course.

Mr. MARKON. In the statement I made in the Armed Services Committee, I explained how the budget balancing was accomplished under the present system, and you touched on it this morning. The money in the transaction fund is not in a separate fund. It is just an account number in Treasury. It is used by the Treasury Department without paying any interest. The projected sales from the stockpile over the next several years are included in the budget as offsetting receipts.

The budget is reduced by the amount of money of projected sales. OMB projected we would have $2 billion in sales over the next 3 years out of stockpile, so the budget was reduced by the $2 billion potential receipts. The actual sales receipts will be less than 1 percent of that. But the gambit accomplished the OMB purpose because the appearance of a budget decrease is there.

Mr. GLICKMAN. A fairly typical bureaucratic Budget Office response to this kind of a problem.

Mr. MARKON. I think we have the same thing on the real property. OMB projected the sales of $17 billion income. The current receipts are running less than last year's receipts. Interior has now reduced their projected sales down to about 1 percent. But when they made the announcement, it served its purpose.

Mr. GLICKMAN. Thank you very much.

Our next witness will deal with the issue of minerals exploration.

Our first witness is Thomas Walthier with the Minerals Exploration Coalition.

STATEMENT OF THOMAS N. WALTHIER, MINERALS EXPLORATION COALITION, ACCOMPANIED BY GERALD E. RUPP, CHAIRMAN, BOARD OF DIRECTORS, MINERALS EXPLORATION COALITION; AND MAJOR W. SEERY, VICE CHAIRMAN, MINERALS EXPLORATION COALITION

Mr. WALTHIER. Mr. Chairman, I am Tom Walthier, and I am vice president of exploration of St. Joe Minerals, and I am also here representing the Mineral Exploration Coalition, which is a tax exempt industry trade association composed of individuals and companies interested in mineral exploration and the domestic mining industry.

I have with me on my left, Mr. Gerald Rupp, chairman of the Mineral Exploration Coalition, and also manager of land for Anaconda Minerals Co.; and on my right with the charts, is Major Seery, director of the Mineral Exploration Coalition and administrative director of Goldfields Mining Co.

We are all three professional geologists. I prefer the term "explorationists." We would like to give you our views on mineral exploration as it stands to date.

Mineral exploration in the modern scientific organized approach to the search for new mineral deposits is a new discipline. It had its embryonic beginnings in World War II with the secret search for uranium. Out of that came the Atomic Energy Commission's search for uranium, which was really the first scientific organized search. That was in the 1940's and 1950's.

Then the commodity of main interest to the organized search became copper, and the mining companies, the private industry, in this country and elsewhere, put on a major search for copper, rather successfully. Then uranium came back in in the 1960's and 1970's as a source of power for the nuclear industry. Currently, the main thrust of modern exploration is for gold.

The point is that mineral exploration is a new concept, at the most 40 years old, and really only 20, and the new technology and new concepts of how to find and look for ore are truly a major thrust of the last decade or two. I think the significance of this is that many areas of the world, including this country, have never really been explored for most commodities. There are parts of the country that have been well explored for a certain commodity, but, in general, there are huge areas that have been poorly explored, and not by modern techniques for most commodities.

I would like to go a little bit into the process of how you go about setting up an exploration program. I am talking now about the private sector, but there are ramifications, as I will discuss later, for the public sector—the public land policy of the Government.

Exploration starts with a policy decision. You decide what you are going to look for and where you are going to look for it. You don't go out and look for everything and anything all of the time. It has got to be a specific project looking for specific commodities in certain areas. The criteria of where you look is a function of the

geology, the probability and the favorability of the rocks for discovery, and, of course, the political and financial environment in which you will have to operate.

The search begins usually with a literature study, published and unpublished records, trying to determine as much about the geology and the geologic conditions under which this type of commodity formed. You look for analog of known mines. You develop geologic theories with academia and industry on how ore bodies are formed. Then you try to visualize where similar situations may prevail to help zero in on how to find a deposit.

There are, obviously, from time to time, serendipitous discoveries, and this broadens and enhances conceptually how things are formed, and may open entirely new areas for exploration potential which, before this accidental discovery were thought to have low potential. This is happening all of the time.

Then you go out in the field and look at broad areas, thousands of square miles that may be the geological terrain. It may be you start with airborne programs, airborne geophysics, or even satellite imagery analysis, airborne photography. Then you hope to zero in more closely with geophysical anomalies, structural interpretations you can interpret from the pictures.

But, eventually, you must get on the ground. You have got to see the rocks, you have got to touch them and feel and smell them, and you have to chip off pieces so you can take them out for analysis. I am talking now about an analysis, not like the old percents analysis, but about analyses routinely on parts per million and parts per billion as clues and hints that there may be something there. Possibly we drill a few holes just for geologic information. Usually we walk away. We haven't found anything, and we go on to other areas. Usually the impact is negligible. The impact is a few geologists walking over the area, and nobody ever knows we were there after a year.

This does not mean to say when we walk away, there is nothing there. It just means that we haven't got the state of the art to find it. Negative information is never final, whereas, obviously, a discovery is positive.

As we proceed, the area of interest becomes smaller and smaller, and the work becomes more concentrated. Obviously, then we start drilling for underground sampling.

The actual case history of a company's record is interesting. Cominco, a large mining company of Canada, and one of our more respected competitors I might say, has published their exploration record for 40 years. This is just the beginning of modern exploration, so it includes some of the premodern, plus their modern technology.

I am going to ask Mr. Rupp here if he will summarize their 40-year exploration history. We have a chart here, Mr. Chairman.

[Chart shown.]

Mr. RUPP. This chart summarizes the Cominco study. This chart is in the testimony on page 3 for those of you in the audience who can't see this chart.

Over a 40-year period, Cominco had approximately 1,000 properties in which they had some property interest and/or on which they had done some work. Of those 1,000 properties, only 78 were

sufficiently attractive to justify doing some major work. Of those 78, only 18 proved to be sufficiently attractive that Cominco developed a mining operation. Unfortunately, of those 18, the majority, 11 of them, did not prove sufficiently profitable to allow Cominco to receive its investment. Only 7 out of the original 1,000 properties were sufficiently profitable that Cominco recovered its money on those operations. These 7 projects also had to pay for all of the other referenced properties and projects.

This was one company's effort over a 40-year period. Different companies will have different results. Cominco might have different results over a different time period. But it illustrates the high risk involved with minerals exploration.

Mr. WALTHIER. Thank you, Jerry.

In summary, exploration, like research and development in other industries, is high risk, and it starts out with a very broad-based scouting of vast areas. We essentially walk in, look around, and usually leave. As the exploration process proceeds, we get into smaller and smaller areas and, eventually, end up drilling with encouragement.

In environmentally sensitive areas, we go to unusual lengths to preserve the state of the surface and the natural environment.

I am going to ask Major Seery if he will show some photographs of how we actually go about a drilling project in a sensitive area in Montana, and clean up before we clear out.

[Photographs shown.]

Mr. SEERY. These are photographs taken in a wilderness area of a drilling project ASARCO did 2 or 3 years ago. You see a picture of the general drilling operation in progress here, with some closeups of how they used pallets and astro turf to protect the environment. They used mud tanks so there was no discharge to the environment while they were drilling.

These are some pictures taken a year later. This picture is a closeup of the actual drill hole. It is very difficult to see in the picture. This picture is the general drill site 1 year later. You can see the effect on the environment was minimal.

Mr. WALTHIER. Major, before you take off the microphone, would you put up the other chart on timespan of exploration.

I might say that it is often nice to know what your competitors did before you and find out where they did their drilling. Even without these elaborate procedures, in a few years, it is extremely difficult to find a drill site.

[Chart shown.]

Mr. SEERY. This is a hypothetical, perhaps idealized, schedule or timeframe for discovery and development of an ore body. The exploration phase here is, as I say, idealized in the sense that you very seldom discover something within 3 years. But, if you are lucky, you might have a discovery in 3 years.

Then you get down to the other phases of continued drilling, confirmatory drilling, bulk sampling, engineering, and economic studies, environmental survey, control, and permits—which is a very important part of all of this—and the actual design, engineering and construction phases. Typically, with good luck, from the point of discovery of a new mineral deposit to production, it is somewhere in the order of 8, 10, 12 or 15 years.

Mr. WALTHIER. Thank you, Major.

In summary, then, what we would like to emphasize is that exploration requires access to large areas of land, but we can do this in an environmentally compatible manner.

The timeframe between the start of a search and production is a decade or more. Modern exploration is a new process and a continually evolving one. I think it is important for the defense of this Nation that we cannot count on exploration and new mines being put into production in a few months or a few years. We have to think in terms of a decade.

Next, I think, in considering public land policy by the U.S. Government, the practice of making a government survey of mineral potential or a mineral inventory of huge areas is simply not the answer. Because of the state of the art, we are incapable of making that kind of a definitive decision and declaration.

Thank you very much, Mr. Chairman. We are here to answer any questions you may have.

[The prepared statement of Mr. Walthier follows:]

MEC

MINERALS
EXPLORATION
COALITION

Minerals Advocate
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Statement of

Dr. Thomas N. Walthier
Vice President-Exploration, St. Joe Minerals Corporation

on

Domestic Mineral Resource Potential

before the

Subcommittee on Transportation, Aviation and Materials
of the Committee on Science and Technology
United States House of Representatives

May 18, 1983

Washington, D.C.

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MR. CHAIRMAN, and members of the Subcommittee, my name is Dr. Thomas N. Walthier and I am employed by St. Joe Minerals Corporation as Vice President of Exploration. I am here today speaking on behalf of the Minerals Exploration Coalition, which is a non-profit trade association of companies and individuals engaged in mineral exploration, who are concerned about land use decisions and other governmental policies that affect mineral exploration and the ultimate health of the domestic mining industry.

I want to talk briefly today about the philosphy and methodology of minerals exploration; environmental, financial, and economic matters affecting the industry; and how these factors relate to the issue of assessing domestic mineral resource potential. After discussing the need for a domestic minerals industry, we will take a look at some of the problems we believe must be solved to ensure the stable supply of materials as endorsed most recently by the National Materials Policy, Research and Development Act of 1980.

PHILOSOPHY OF MINERALS EXPLORATION

Minerals exploration in the mining industry is analogous to R & D in other industries: it is essential to stay competitive and in the business. The risk is high, as in R & D. A typical example of the risk is an internal study published by a large Canadian mining company, Cominco Ltd., several years ago. Over the course of 40 years it explored in some detail over one thousand

properties. (This does not count the numerous properties they examined briefly and walked away from, but just the properties where they acquired legal rights to the property followed by serious evaluation.) Of the 1,000-plus, only 78 merited major work (i.e., extensive drilling). Eighteen ore bodies were discovered and were brought into production. However, only seven of these returned enough profit to recover the investment. (Figure 1.)

You might wonder why with such discouraging odds anyone spends money on exploration. The answer, of course, is the anticipation of striking the one-in-several-hundred desposit that is rich enough to make up for all the marginal ones and "losers." The odds are against success at any particular prospect, but exploration that is carried out prudently and competently, over a long enough time span, reverses the odds. It then becomes probable that a major discovery will be made, erasing past losses and resulting in an overall profitable program, even adjusting for the time discount of money. But the financiers and stockholders supporting such exploration programs must have long-term confidence in the political system. The exceptional rewards from the rare bonanza must be theirs to enjoy and not lost through special and punitive legislation or regulations. If no "Jackpots" are allowed, there are no players. Exploration is carried out only in those areas that the entrepreneur considers geologically favorable for a major discovery and are perceived to have an acceptable, stable political climate. There is no

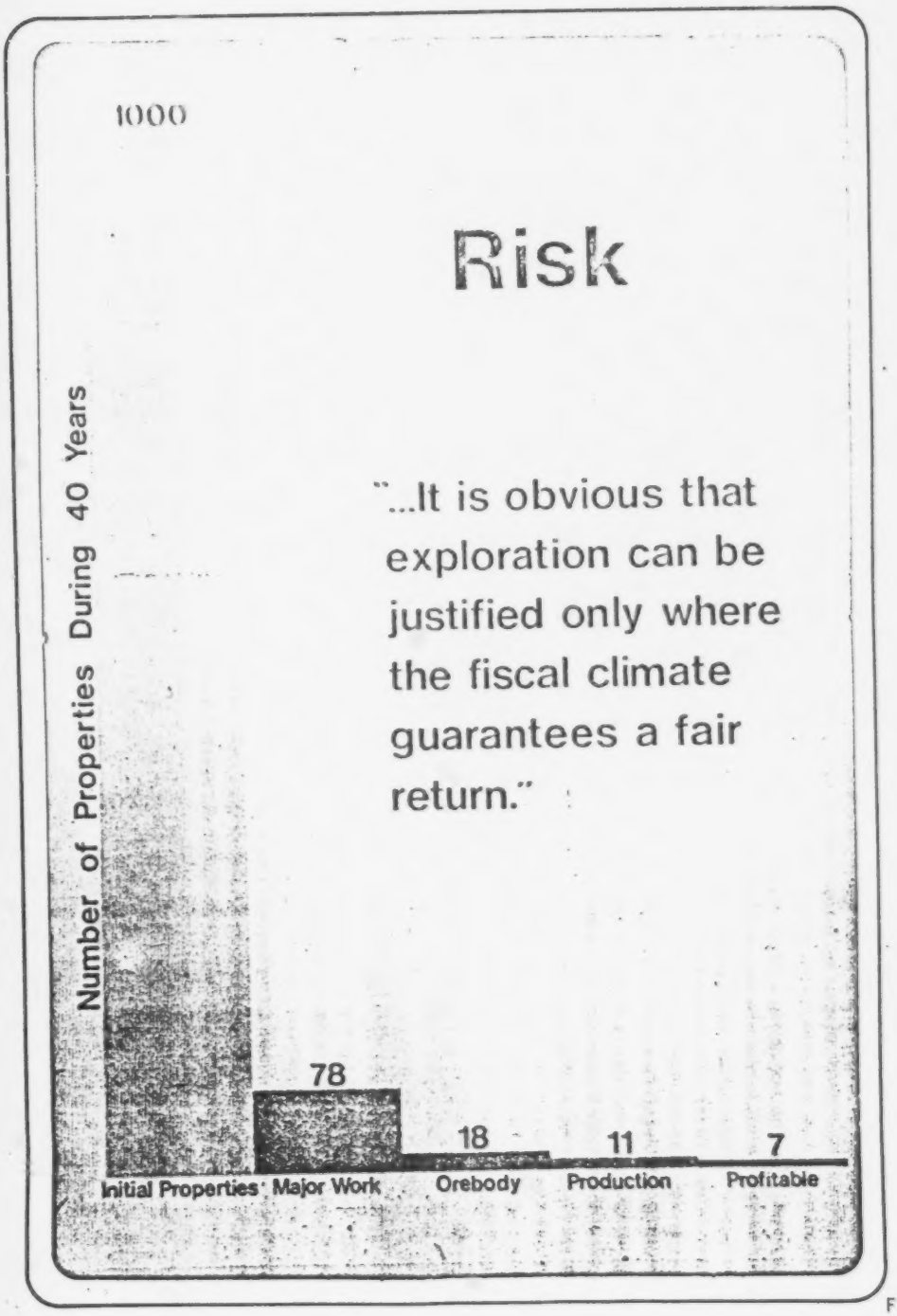


FIG.1

25-958 O—83——11

question that the total gross value of minerals discovered and their value to the economy as a whole, far exceeds the money spent on exploration.

EXPLORATION METHODOLOGY--Early Phases

Exploration begins with a policy decision on what commodity(ies) to search for... and where. Library studies follow: researching published sources and unpublished records for geological and geochemical data and concepts on how the favored mineral may have been concentrated during geologic time. From this, a few geologic terranes emerge as more likely places to look. Certainly, geologic situations that resemble the settings of known ore bodies elsewhere receive special attention. Obviously, those exploration teams that have the more comprehensive experience with the world's known ore bodies and geological processes are more likely to succeed. Let us emphasize that good exploration practice is not random, but specific. You don't look for anything and everything everywhere. To be sure, serendipitous discoveries occur, which in turn may modify and enlarge the concepts of how to find that specific metal or mineral. This phase is inexpensive and obviously has no environmental consequences.

The next phase of exploration might include airborne techniques such as; air photo geologic mapping, magnetic, electromagnetic or gamma radiation surveys over selected areas. Sophisticated computer evaluation of Landsat reflectance data is proceeding at

a remarkably rapid pace. The cost per acre of airborne coverage is still small and environmental impact is nil. In some situations, widely spaced drill holes are used to verify suspected buried geologic conditions and terraines. At this stage, clues emerge as to where to concentrate the next exploration activity.

It is important to remember that, as in all exploration phases, the lack of positive information does not signify a negative exploration potential...only that the "state of the art" is not advanced enough to identify all discovery opportunities.

Ground Surveys

Next we move to ground surveys--geochemical, geophysical and geological mapping and plotting of rock features and surficial sampling. At this point, freedom of access to the area on the ground is imperative. We simply have to see and touch the rocks, and break off chips for assay, to be able to proceed further. Ground geophysical surveys are needed to precisely quantify and locate airborne indications. We now may have some impact on the environment, though usually an almost indiscernible one--claim stakes, survey markers, occasional brush clearing for visibility and minor trenching for sampling purposes. Hopefully, by now we will have identified one or more specific targets requiring underground sampling...usually done by drilling. If not, we will probably move on to another area. As the Cominco Ltd. data show, the large majority of exploration projects abort here. We leave and no one will be aware we ever set foot there.

Underground Sampling and Final Phases

Ultimately, the only way to find an ore body is by underground sampling, again, usually by drilling. The environmental effect varies depending on the circumstances surrounding the size and location of the drilling program. Most drilling programs encompass only a few acres, unless the operation is defining an ore body which would require an intensive drilling program possibly covering almost 500-600 acres. A typical core drilling program using mobile ground based drills might cost $23-30 per foot of drill hole. (A helicopter-supported program could cost two to three times as much.) By this time, we are obviously in a very expensive phase of exploration. Few companies will proceed very far into a drilling program without significant encouragement.

The last phases of exploration costing into the millions of dollars typically include bulk sampling and extensive metallurgical testing, leading to feasibility studies and project engineering.

ENVIRONMENTAL CONCERNS

Exploration starts in the field b/ broad reconnaissance over wide areas involving thousands to tens of thousands of acres; however, it is a transient use of the land with no noticeable effect on the environment. As the search narrows, the occupancy of the land is longer but also temporary. In environmentally sensitive areas, special procedures can be employed so that, again, no

permanent noticeable environmental effect is incurred. We are attaching, as Appendix A, photographs of an exploration program conducted in a wilderness area in Montana to document current, environmentally responsible, exploration practice.

Only with discovery, a rare event as we have seen, is occupancy longer...several decades. But the disturbed area is restricted to very small acreage. Modern mining practice minimizes the environmental impact during mining; and after the operation ceases, the land is reclaimed to a beneficial use.

FINANCIAL/ECONOMIC FACTORS

Exploration Lead Time

A critical point to remember in helping understand the industry's ability to respond to changes in demand for minerals, or on the other hand to withstand economic cycles, is the time frame involved in the explorati process. (Figure 2.) Phases one to three typically take from one to three years to complete. Phase four--drilling--may take an additional one to three years or more, depending on the geologic complexity of the deposit, technical or environmental problems present, and the economic strength of the exploring company. An additional year or two for the last phase, followed by two or three years of construction, adds up to eight to ten years from the start of a successful exploration program to first production. (Figure 3.)

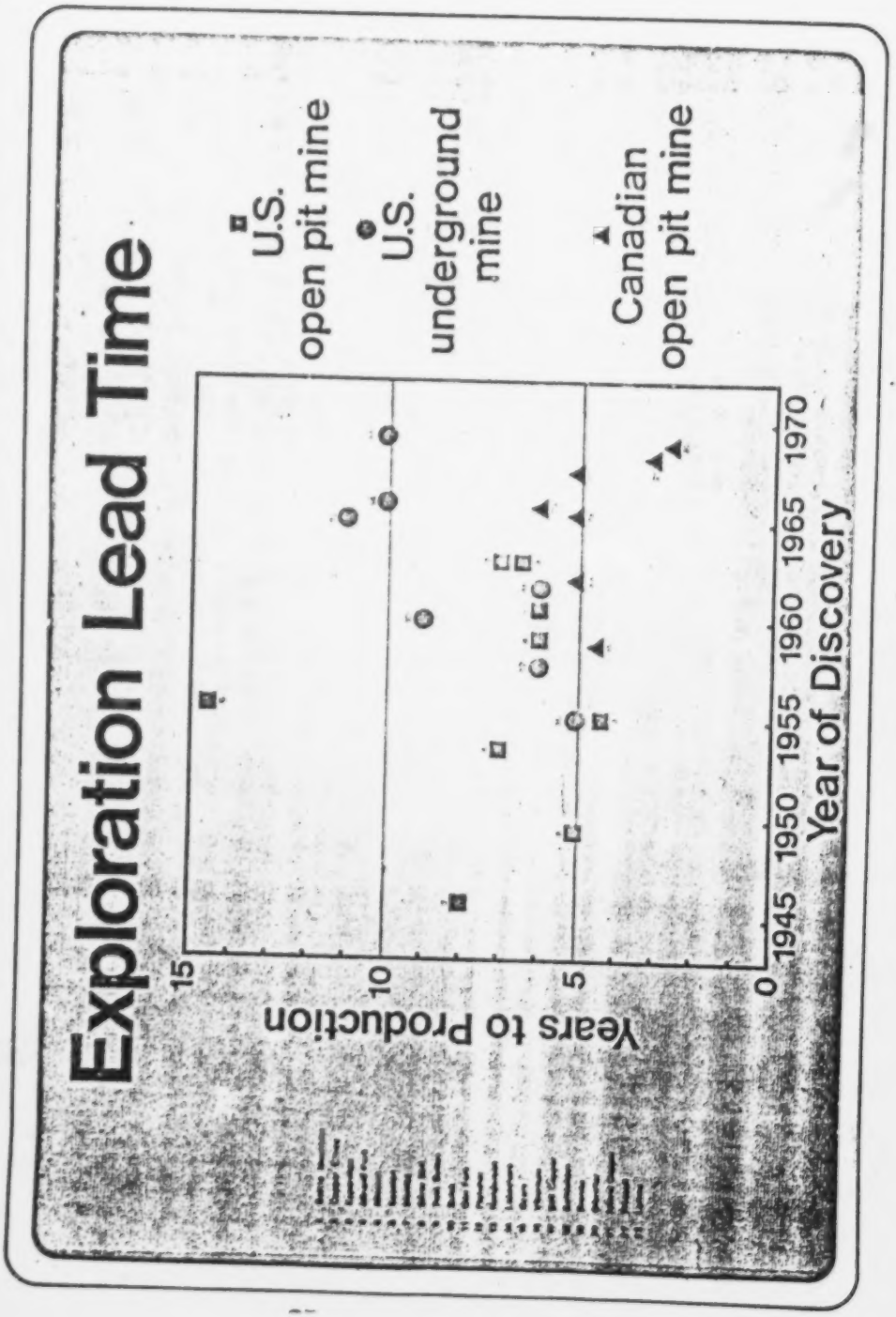

Exploration Lead Time
U.S. open pit mine
U.S. underground mine
Canadian open pit mine
Years to Production
15
10
5
0
1945
1950
1955
1960
1965
1970
Year of Discovery

FIG.2

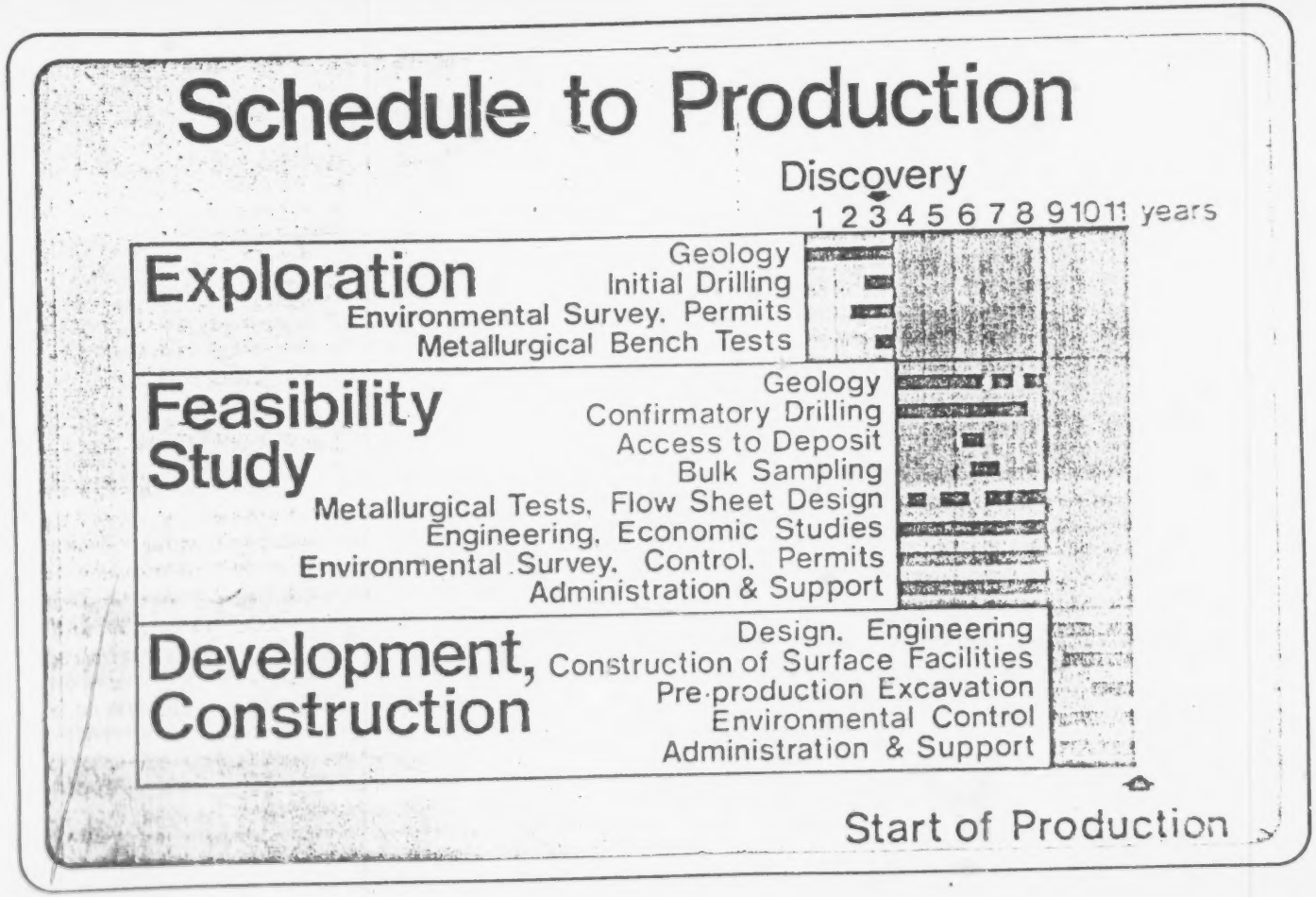

Schedule to Production
Discovery
1 2 3 4 5 6 7 8 9 10 11 years
Exploration
Geology
Initial Drilling
Environmental Survey. Permits
Metallurgical Bench Tests
Feasibility Study
Geology
Confirmatory Drilling
Access to Deposit
Bulk Sampling
Metallurgical Tests. Flow Sheet Design
Engineering. Economic Studies
Environmental Survey. Control. Permits
Administration & Support
Development, Construction
Design. Engineering
Construction of Surface Facilities
Pre-production Excavation
Environmental Control
Administration & Support
Start of Production

FIG. 3

Other Concerns

Outside factors, whether they be technologic or economic, may change what was once useless rock into valuable ore. Yet the severity of the current depression in the domestic minerals industry can be viewed as a mirror-image of the rags-to-riches story reflecting recent financial and economic conditions.

The average rate of return for the mining industry is one of the lowest in our economy. A recent article in Fortune noted a less than 7 percent return on investment for the industry.

Concern has also been expressed about the international development banking community's support of foreign mining projects. Probably the most current example of this issue is the World Bank International Finance Corporation's financing package of $1.0 billion to expand Mexico's Cananea copper mine, mill and smelter from 50,000 to 150,000 metric tons of annual capacity.

Within the past four years, the international development banks have participated in eight projects in six countries (Bolivia, Ecuador, Mexico, Morocco, Peru and Zambia) designed, at least in part, to increase copper production, and have four more such projects (in Bolivia, Peru, Zaire and Zambia) under consideration.

ASSESSING MINERAL POTENTIAL: Metallogenetic Theory

One final point is worth emphasizing, especially in regard to the issue of assessing the mineral potential of the public lands. MINERAL ASSESSMENT IS NEVER FINAL. Effective mineral potential assessment has to be regarded as a continuing process rather than a one-shot decision.

Exploration technology and new insights into ore formation processes--metallogenesis--change and improve our assessment capabilities. Metallogenetic theory, one of the single greatest advances in the science of exploration, progresses with each new discovery of an ore body as the potential of a geologic environment is reinterpreted based on new information.

Geologic concepts today are being radically changed. Plate tectonics, and the very recent oceanographic discoveries of metallic sulphide deposits forming now on the deep ocean floor, are only beginning to have an impact on how we view the genesis of certain orebodies... and hence how and where to look for them. Serendipitous discoveries will open up areas as prime exploration environments that previously were considered of low priority. New techniques will continue to be invented, serendipitous discoveries will surprise us, and geological science will evolve further.

As the years pass, the near surface ore bodies are preferentially found, leaving the task of discovery ever more difficult. We

must look deeper and be more astute, as nature is devilishly clever in hiding them. As we go deeper, we can pass into different geologic environments and the surface geology is no clue to what lies below.

(A very good paper entitled "Assessing the Mineral Potential of Federal Public Lands," by John J. Schanz, Jr., and John G. Ellis of the Library of Congress, was published very recently. Though the aim of this study was assessing mineral potential of large areas, as opposed to exploring for an ore body which we are addressing, the methodologies and levels of uncertainty are much the same. We recommend their paper for a more thorough treatment of the subject.)

It must be stressed that government sponsored programs to "inventory" the public land are not the answer to assessing the potential of the land.

Technological Advances

Organized, scientifically based, exploration for hard minerals, utilizing sophisticated geophysics and geochemistry, is a modern development. The top secret search for uranium during World War II was the initial project. "Modern" exploration began with the Atomic Energy Commission's sponsored search for uranium in the late 1940s and early 1950s. Since then, more kinds of metals have been looked for, and research into new geophysical techniques have evolved, and so too with the science of

geochemistry. Each innovation permits a major reassessment of old areas. We are attaching as "Appendix B" a list of examples of new mineral exploration technologies. These range from "waterborne induced potential" (W.I.P.) geophysics to vertical gradient magnetometers and most are currently available for production use.

IMPORTANCE OF DOMESTIC MINERAL INDUSTRY

Why do we feel a domestic mineral industry is important? Because it is needed to provide the U.S. a local, secure source of raw materials for its basic industries. The word "secure" implies protection from economic exploitation that can develop if we are dependent only on foreign sources, and it implies availability of raw materials in the event of armed conflict. All countries recognize the economic and military significance of raw material availability. We can't wait for an emergency to start the search...it takes the good part of a decade to start producing.

Some would argue that basic industry in America is passe; the future belongs to "hi-tech." Not so. In a speech given last March by Mr. Roderick, CEO of U.S. Steel, he said basic industry for the past decade supplied 41 percent of manufacturers' shipments and provided 20 million jobs. Hi-tech industries provided 3 percent of shipments. Doubling hi-tech production could not begin to substitute for a contraction of basic industry employment.

The U.S. did not forego agriculture as it industrialized. We are not a post-agrarian society, but the greatest agricultural supplier in the world.

As a nation we can feel very secure and fortunate that we are self-sufficient in food production. Let us not be blase about the need for basic industry and self-sufficiency in raw materials.

CONCLUSIONS AND RECOMMENDATIONS

We believe the private exploration industry, with reasonable cooperation from the government and public, can meet the needs of the country for a reasonably stable, secure supply of materials.

We offer the following recommendations for your consideration:
1) Efforts must continue to enforce and implement the National Minerals and Materials Policy, Research and Development Act of 1980 and the President's April 5, 1982 National Materials and Minerals Program Plan. Government agencies should work toward increasing their capability to provide mineral supply and demand forecasts.

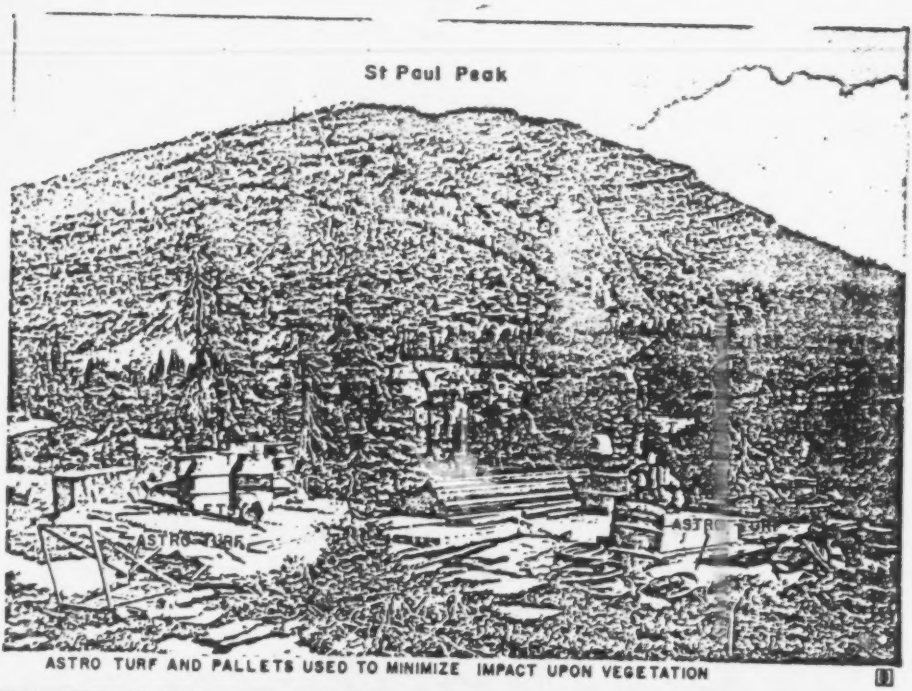
2) We need better access to the public lands. The Bureau of Land Management should continue its review of land withdrawals to determine which withdrawals are outdated and unnecessary. As outlined in the President's message, BLM solicited nominations from the public for areas of critical mineral potential. Our

information indicates that 87 submissions were received by BLM covering 320 areas of high mineral interest in eleven states. The agency should review these submittals in a timely manner and incorporate the information into their ongoing planning process.

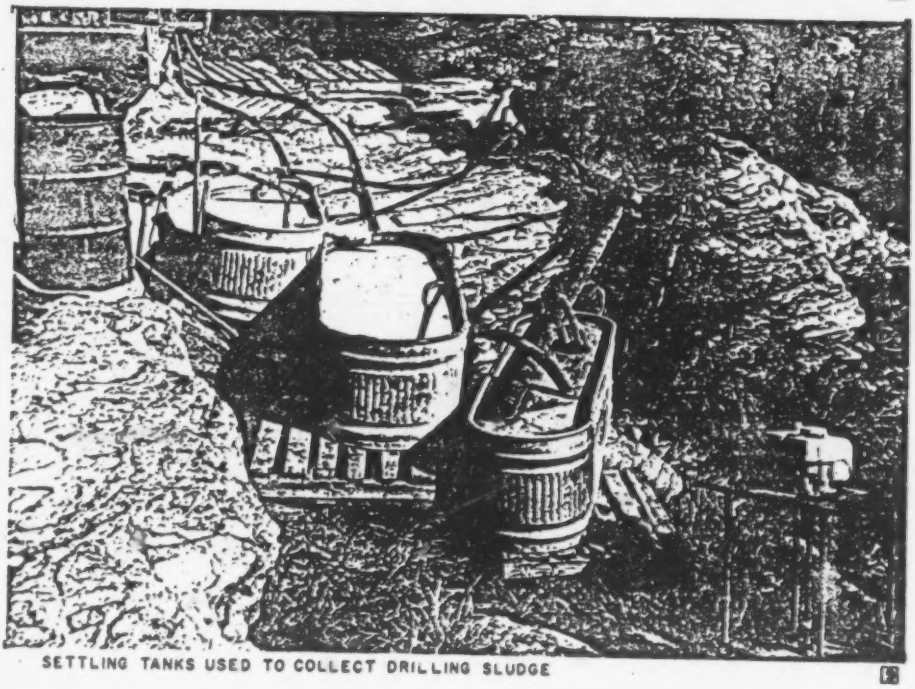
3) Above all we need better understanding by lawmakers such as yourself and the general public, of the importance of the mineral industry to our society. We stand ready to do anything we can to further that understanding.

We thank you for the opportunity to make this presentation and we will be happy to answer any questions you have.

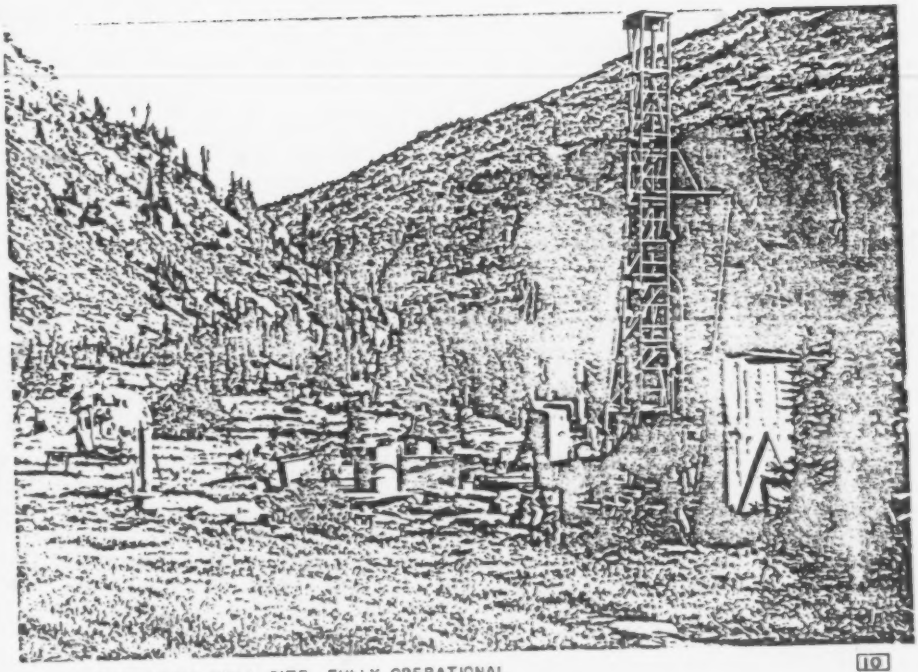
APPENDIX "A"



ASTRO TURF AND PALLETS USED TO MINIMIZE IMPACT UPON VEGETATION

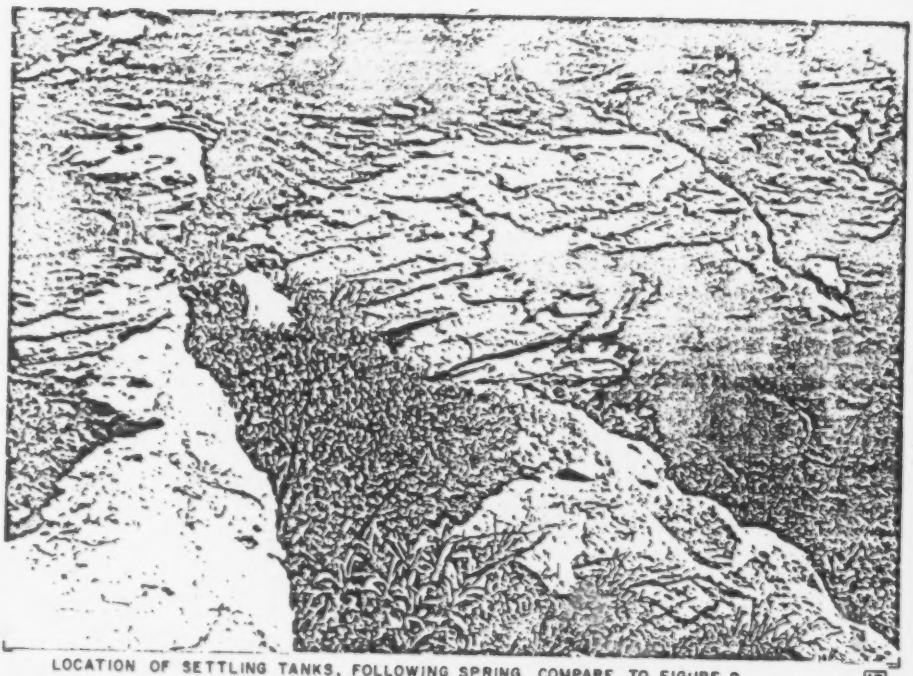


SETTLING TANKS USED TO COLLECT DRILLING SLUDGE

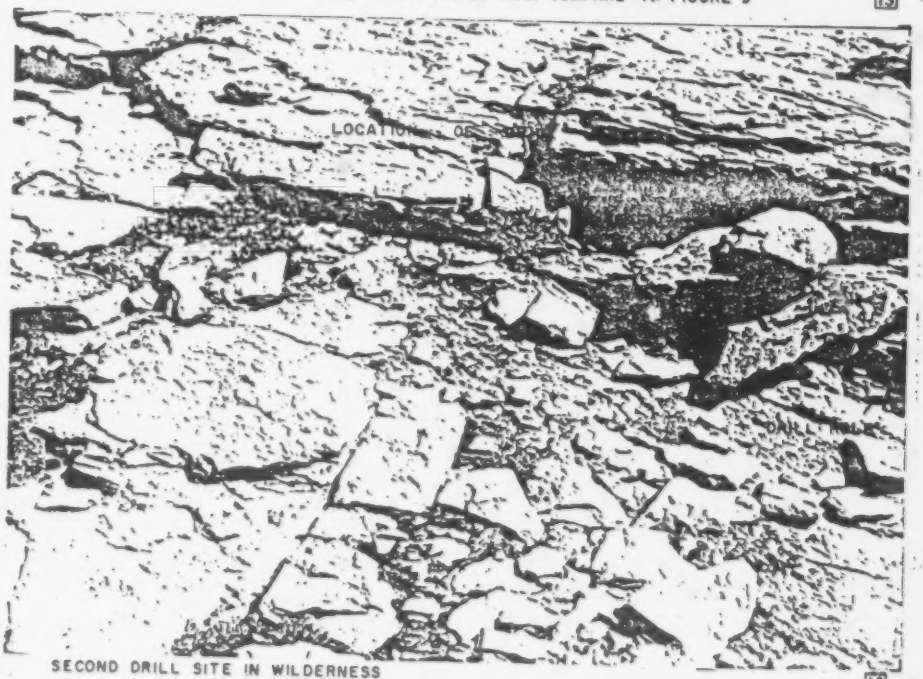


COMPLETED DRILL SITE, FULLY OPERATIONAL

10



LOCATION OF SETTLING TANKS, FOLLOWING SPRING. COMPARE TO FIGURE 9 13



SECOND DRILL SITE IN WILDERNESS 14

APPENDIX "B"

NEW MINERALS EXPLORATION TECHNOLOGY

(of last few years)

The following are not listed in any order of importance nor is the list exhaustive. Unless noted otherwise the technologies indicated are currently available for production use.

(1) Sonic drills for the sampling of unconsolidated materials. *M.E.I.

(2) Waterborne Induced Potential geophysics (W.I.P.). M.E.I.

(3) Integrated Electro-Magnetic geophysics (I.E.M.). Both surface and airborne. Virtually instant feedback and analysis. M.E.I.

(4) E.M. Pulse, and Audiomagnetotelluric geophysical systems provide very deep (1000') penetration into the earth's crust.

(5) The Russians claim to be able to interpret the grade (eg. Percent Copper) by a modified geophysical technique. This is not substantiated yet.

(6) Remote sensing systems, both satellite and airborne, measure spectral parameters. The latest innovation is image enhancement by automatic ratioing. Systems detect vegetal or soil stress. In the past "highs" were of interest. In the future "lows" will be utilized. Photographic improvements and digital recording have been important. M.E.I.

*Minimal Environmental Imact.

25-958 O—83——12

(7) Mini-computers particularly as reflected by the impact of micro-processors have beneficially impacted on geophysical, geochemical techniques. Automatic processing and new mathematical manipulation have made exploration more efficient. Computers now go into the field, are even airborne and/or can be electronically connected to main frame computers 1,000 miles away. M.E.I.

(8) Exploration geology has witnessed a conceptual revolution akin to the change from alchemy to modern chemistry in the last twenty years. New deposit types are being recognized and the pace of change is still high. Books have been or are being written about these. The recent discovery of active ore forming hot water vents on the sea-floor is one such item which has reached the popular press. Thus resource assessment based on the status quo is rapidly becoming obsolete. M.E.I.

(9) Geochemical technology is continuing to develop rapidly. Costs continue to fall.

(a) Genetic engineering of hunter bacteria is feasible but not currently available.

(b) Soil-air composition can be utilized.

(c) Vegetal and soil materials are being utilized directly for discovery of anomalous concentrations of very rare elements (eg. gold).

(d) Direct reading field instruments are available for some elements; ultimately, obviating the necessity of some sampling.

(e) "Plasma" and "Neutron Activation" techniques routinely provide high quality data. Parts per billion sensitivities are now routine. Parts per trillion are on the horizon. Real costs per analysis continue to decline.

(f) Airborne geochemical systems are currently being tested. These ultimately will have parts per trillion capacity, like some species of moth.

(g) Halo effects providing vectors hundreds and in some cases thousands of feet from some types of deposits are currently being measured. These may be "frozen" in the composition of the whole-rock or preserved within individual minerals.

(h) The microscopic contents of individual fluid inclusions within individual minerals can now be analysed directly and quantitatively providing clues as to the origin and direction of mineralizing fluids.

(i) Small quantities of non-combined gases of which the presence was not previously suspected have recently been discovered occupying intra-folial positions in platey minerals near ore bodies. These gases are believed to be a "memory" effect of mineralization which survives low grade metamorphism.

(j) Isotopes of sulfur, oxygen, uranium, lead and other elements are being measured and their distribution used to indicate the presence and in some cases the age of mineralization.

(10) Vertical gradient magnetometers in the air or on the ground are now widely used for accurate definition of hidden geological contents characterized by even very weak magnetic contrast.

(11) Vastly improved mathematics, assisted by the computer revolution has many direct impacts on exploration leading to more efficient drill patterns (less holes), logical as opposed to empirical reserve estimates, improved risk control, standard normalization of multi-variate data and much better noise/signal discrimination.

(12) Communication of data in exploration can now be direct on-line. For instance analytical data (see earlier) can routinely be automatically telexed to the user as it is being produced with or without statistical treatment as desired.

(13) Metallurgical improvements continue to widen the scope of what constitutes ore; for instance, by lowering acceptable grades, allowing not only lower grade deposits of certain known types to be exploited but also expanding the search to other types. Such developments have had and will continue to have a prominent negative impact on the reliability of any resource assessment.

(14) Remotely controlled sea-bed scanners capable of operation beneath greater than 10,000' of water are now available. Their development was a direct result of the discovery of deep sea ore systems mentioned in (8).

(15) The electron microscope, probe, and its relatives are routinely being used to identify very rare mineral species, and their mineralogical and textural associations.

(16) The quantities of individual minerals in a rock mass are now being routinely measured by X-Ray diffraction. Direct vectors

reflecting the increasing intensity of mineralization far beyond the occurrence of the desired economic species can thus be measured.

(17) Laser beam projectors ("ray guns") both on the ground and in the air are currently being used for the direct detection of certain mineral species.

(18) Air-borne gravity measuring devices, not long ago believed to be a technical impossibility, are now a production reality.

(19) Direct observation from the space-shuttle or, in the future, from space-stations orbiting earth, now and inevitably in the future will assist our understanding of the crust and thus exploration.

Roland H. Ridler

May 6, 1983

Mr. GLICKMAN. I want to thank you for being here and for your excellent testimony. I have a few questions for you.

My first question is one that I tried to get a determination from the administration witnesses and was not very successful. That is what is known about the domestic minerals potential on public lands? Specifically, are there identified economically tractable deposits of minerals containing chromium or cobalt, or whatever else, on public lands? That is the first question.

Mr. WALTHIER. I am going to turn it over to Major. But, in general, as I have said, exploration is really a new thing, and there are lots of areas that have never been explored. So I would say the potential is good.

Major.

Mr. SEERY. The answer really is that we don't know at this stage. We brought along some maps that the USGS published in 1979 and 1980 which show the known occurrences of strategic minerals, such as cobalt, chromium, platinum group metals. We can submit these for the record.

There are two significant things about these maps. One is that, in the occurrences listed on the side of the map—they have a table which shows whether the geologic information is fairly complete or incomplete—in most of these occurrences, the information is very incomplete. They are known, but very little work has been done on them. The second significant point is that the majority of the known occurrences are located in areas which have been withdrawn from mineral exploration.

Mr. GLICKMAN. Let me follow up. You emphasize in your statement that Government-sponsored programs to inventory the public lands are not the answer to assessing the potential of the land. I wonder if somebody could elaborate on that statement? Wouldn't they be part——

Mr. WALTHIER. They would be part, but they are never definitive. Negative information is never the final answer, because there may be deposits concealed and not found due to the present state of the art.

Mr. GLICKMAN. But you don't object to Government inventory. After all, USGS has been doing that for years.

Mr. WALTHIER. I don't object to it if it is looked at in the proper perspective.

Mr. GLICKMAN. I realize that you are not going to spend large sums of money strictly on the basis of a Government inventory. I would assume that that would be useful to you.

Mr. WALTHIER. It is useful data and, as long as the data is used in the proper perspective, that this is not a final inventory, it is part of our search in the beginning to know where to start to look.

I might give a case history of St. Joe. A couple of years ago, I said to our exploration staff that I think we ought to become specifically interested in looking for some of the strategic metals. Within 1 year, we have turned up several very interesting prospects of a certain strategic metal on public land which is completely unknown, and it is in a relatively uninhabited area.

Mr. GLICKMAN. Have you disclosed this?

Mr. WALTHIER. No, we have not. I prefer at the moment not to. I don't know whether it is an ore body, but it is a very exciting and interesting concentration of metal.

Mr. GLICKMAN. In your statement, you identified some surveying techniques that are available which might demonstrate minerals potential without compromising the environment. Have you talked with any of the people in the environmental community regarding their concerns with these techniques?

Mr. WALTHIER. We have had dialogs over the years with them, certainly.

Mr. GLICKMAN. Do you think these new techniques are in fact significant in terms of permitting discovery of minerals potential without much degradation of the environment?

Mr. WALTHIER. It is not only the new techniques, but it is also a new attitude, I think, not only of the mining industry, but of much industry, that this generation is conscious of the environment, and we do things differently than would have been done 50 years ago. It is just like the difference between alchemy and modern chemistry. There is a whole new technology that permits us to do things which we couldn't do before.

I think you have to look at the modern techniques and the modern attitudes and approaches to exploration in your attempt and desire to preserve the environment.

Mr. GLICKMAN. Is there additional research and development that could be done to devise techniques which could in fact provide you a better assessment of minerals potential without drilling cores. For example, like magnetic techniques, satellite capability, or related techniques?

Mr. WALTHIER. I think they are very useful in that early stage—that red part of the graph—early part of the exploration. Many companies are using satellite imagery and very sophisticated computer analyses of the various wave lengths. That is a great break through. There is all of the airborne geophysics. There is geochemistry where small chips of rock along with very precise and new analytical techniques are giving us great insight into how to explore.

But, eventually, we have got to get in and sample underground. That means drilling or going underground with a tunnel.

Mr. GLICKMAN. Can you give us any advice on what additional role the Government could have in the R&D side of the picture in terms of funding in this area?

Mr. WALTHIER. The USGS and the U.S. Bureau of Mines do have a very active program on concepts of ore genesis. The Bureau of Mines is developing new kinds of drilling techniques. The USGS is developing new kinds of analytical procedures. There is a great deal being done at the present time by these two organizations and by academia. Whether this could be expanded, and whether it is desirable to be expanded, is a good question. The U.S. Geological Survey and the U.S. Bureau of Mines have a very, very good and healthy program.

I would put a plug in that I would like to see more basic geologic mapping being done by the U.S. Geological Survey like they did many years ago, in addition to the programs they have now.

Mr. GLICKMAN. I think that you have, by showing these pictures, indicated your concern in environmental areas. It is absolutely clear that the American public has put its cards down on the side of protecting the environment on public lands. Therefore, I think it is in your interest to pursue all sorts of research and development techniques which permit you to do some of the initial work without having to drill holes in the ground or drive your trucks through there, or whatever has to be done, realizing, of course, that at some point, a decision has to be made if you are going to mine the area. You can't mine through magic neutron warfare, starbeams, or whatever else there is. I assume from what you are telling me today is that you would support further efforts to take care of the environmental concerns.

Mr. WALTHIER. We very heartily support this philosophy. In fact, we would welcome the chance to show you and the members of your subcommittee some of our operations. We are not like the miners of 100 years ago, anymore than the doctors and surgeons today are like their counterparts of 100 years ago. We are just running a different kind of a show. We would like to show you that.

Mr. GLICKMAN. Maybe one day we will take you up on that offer. Thank you very much for testifying today.

Mr. WALTHIER. Thank you.

Mr. GLICKMAN. That concludes our hearing for today. We will start again tomorrow at 9:30.

We have one witness, Hope Babcock, who was supposed to be testifying today, but it has been deferred until tomorrow. She will be here tomorrow.

[Whereupon, at 11:35 a.m., the subcommittee was adjourned.]

MATERIALS RESEARCH AND DEVELOPMENT POLICY

THURSDAY, MAY 19, 1983

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:40 a.m., in room 2318, Rayburn House Office Building, Hon. Dan Glickman (chairman of the subcommittee) presiding.

Present: Representatives Glickman and McCandless of the Committee.

Also present: Representative Ritter.

Mr. GLICKMAN. Why don't we begin the hearing this morning. I want to welcome our witnesses, and welcome my colleague from Pennsylvania, Don Ritter, who will have an opening statement and then will sit on the panel as long as he is able to do so. It is a pleasure to have you here, Don.

Today is our third day of hearings on materials policy. Today, we consider the Nation's needs and opportunities in high technology advanced materials; research, development, and technological innovation, especially related to substitute materials and new processing technologies are important factors which have the potential to ease our long-term vulnerability to interruption in the supply of critical minerals and materials.

Emerging high technology materials include not only semiconductors, but also new high temperature ceramics, which may lead to total redesign of automotive engines; fiber reinforced plastic composites are now replacing aluminum and other lightweight structures in aircraft; metallic alloys processed by rapid solidification technology that have unusual resistance to corrosion, oxidation and wear; to name a few.

Such advanced materials are ripe for technology—ripe for development and high technology payoff, but require stimulation in both the private and public sectors.

In Japan, MITI announced in 1981 a 10-year industrial-based technology program that includes advanced materials. While it is not necessary that we blindly follow the Japanese or other nations which have recently taken similar initiatives, the Japanese form of government-industry partnership has been especially successful.

And by the way, as Senator Schmitt said yesterday, this is nothing that the Japanese invented, this is something basically that was invented in this country by NASA, and the NASA relationship

with aerospace, aeronautics industry is exactly the model that the Japanese used to build their own MITI structure.

But as a result of what is happening in the rest of the world, we are clearly in danger of losing the advanced materials competition. For this reason, the evolution of reasoned policy, related to the Nation's advanced materials R&D effort is a top priority of the subcommittee.

More importantly, it is necessary that an effort be made to assign responsibility for implementing programs under such policy.

I look forward to the testimony of three eminent materials science and engineer researchers. We are particularly interested in their general assessment of the direction and stimulation required to lead the Nation's materials industries, whether they be in metals, ceramics, polymers, electronic materials, et cetera, into a decade of intense international competition.

[The prepared statement of Mr. Carney follows:]

HONORABLE WILLIAM CARNEY

HEARING ON MATERIALS RESEARCH AND DEVELOPMENT POLICY

MAY 19, 1983

THANK YOU, MR. CHAIRMAN. RESEARCH IN ADVANCED MATERIALS REPRESENTS A POTENTIAL SAVINGS FOR A NUMBER OF INDUSTRIES IN THE U.S. CERAMICS, METAL MATRIX TECHNOLOGY, AND COMPOSITES WILL NOT ONLY REDUCE THE WEIGHT OF AMERICAN-BUILT AIRCRAFT AND AUTOMOBILES, BUT WILL ALSO REPRESENT SAVINGS IN FUEL, PRODUCTION COSTS, AND THESE MATERIALS USE MUCH LESS OF OUR VALUABLE STRATEGIC MATERIALS.

THE U.S. HAS AN AGGRESSIVE R&D PROGRAM IN ADVANCED MATERIALS THAT HAS SPUN-OFF A NUMBER OF NEW DISCOVERIES INCLUDING FIBER OPTICS, RAPIDLY SOLIDIFIED MATERIALS, AND BIOMATERIALS. BIOMATERIALS HAS VERY IMPORTANT APPLICATIONS IN THE MEDICAL FIELD. A NEW SYNTHETIC SKIN HAS BEEN DEVELOPED TO AID IN THE HEALING PROCESS OF SEVERELY BURNED PEOPLE. RAPIDLY SOLIDIFIED MATERIALS HAVE THE POTENTIAL TO LOWER AIRCRAFT WEIGHT, IMPROVE PERFORMANCE, AND SAVE IN EXPENSIVE AND COMPLICATED MACHINING PROCESS.

ANOTHER EXTREMELY EXCITING DEVELOPMENT, MR. CHAIRMAN, IS FIBER OPTICS, A PROCESS WHERE LASER LIGHT IN GLASS FIBERS REPLACES ELECTRIC CURRENTS THROUGH COPPER WIRES. NOT ONLY IS FIBER OPTIC COMMUNICATIONS CHEAPER, EASIER, AND FASTER, IT WILL SOON ALLOW US TO TRANSMIT THOUSANDS OF MILES WITHOUT REPEATERS. THIS WILL SUBSTANTIALLY REDUCE THE EXPENSE OF LONG DISTANCE TELECOMMUNICATION SYSTEMS, ESPECIALLY TRANSOCEANIC SYSTEMS.

WE MUST MOVE FORWARD IN OUR EFFORTS TO DEVELOP ADVANCED MATERIALS. NOT ONLY WILL WE REAP THE BENEFITS OF PRODUCT IMPROVEMENTS, FUEL SAVINGS, AND REDUCE OUR DEPENDENCE ON STRATEGIC MATERIALS, BUT IF WE DON'T MOVE FIRST WE MAY END UP BUYING OUR ADVANCED MATERIALS TECHNOLOGY FROM OVERSEAS.

THANK YOU, MR. CHAIRMAN.

Mr. GLICKMAN. It is a pleasure now to welcome our colleague, Congressman Ritter for his statement.

STATEMENT OF HON. DON RITTER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF PENNSYLVANIA

Mr. RITTER. I thank the Chairman, and I commend the Chairman for taking this strong interest in leading us toward more effective policy in the realm of materials. It is, to me, a bit like old home week, or old home day, having served at one point on this committee.

And I might add to the gentleman from Kansas, the most able subcommittee chairman, that had his fellow Democrats on the caucus been more generous in committee ratios, maybe that is an inside story, I might be serving on this committee today.

Mr. GLICKMAN. I tried my best, there was nothing I could do.

Mr. RITTER. I know that.

Also, it is a bit like old home week in welcoming our panel, former MIT colleagues Dr. Robert Mehrabian and Dr. Merton Flemings, a colleague in the realm of research and materials, Dr. Rustum Roy from Penn State, and a leader in the Nation and the State of Pennsylvania in trying to foster intelligent, not only materials policies, but science and technology policies as well.

So, welcome, gentlemen.

I would like to express my concerns about two issues of national interest, the declining competitive position of the United States basic materials and minerals industries, and the vulnerability of our country to disruption in the supply of strategic materials.

During the last few years, the United States has found that the competitive superiority once enjoyed in many technical areas has been eroded. And in some cases, we have become second-rate.

There has been an inability to effectively bring new discoveries to commercial fruition, in part because of the wrong economic climate; in part because of poor connections between research efforts in Government and private industry.

Even today, there are vast technological and scientific achievements that have been evolved out of Government research and Government-sponsored research that sit unused and unapplied on the shelves while America's technological, competitive position throughout the world declines.

Related to this is a precarious position regarding our ability to maintain military production capacity in view of strong dependence on foreign imports, many from unstable Third World countries, for most of our strategic materials.

So, foreign policy is a part of this problem as well. I became personally aware of the importance of this issue as a prime focus of world competition as a result, in part, of my participation in a year-long scientific exchange in Moscow.

Several years after I returned from Moscow, Leonid Brezhnev said, in 1973, during a speech in Prague:

> Our aim is to gain control of the two great treasure houses on which the West depends: The energy treasure house of the Persian Gulf; and the mineral treasure house of Central and Southern Africa.

I think most Americans don't even know that Brezhnev said those kinds of things, but I think we in the Congress and in the Government and in industry have to be aware of this. We cannot ignore this threat.

As a metallurgist in the U.S. Congress, I have become familiar with exciting materials programs at the National Bureau of Standards. This program has two basic influences on American industry:

First, the possibility of a quantum leap in productivity; second, the prospect of lessening vulnerability to the import disruptions for strategic materials. The program seeks specific technological breakthroughs, such as bringing rapid solidification techniques to metals processing; to a new generation of coatings; and to higher-strength steels; the development of necessary phased-diagram roadmaps for alloy development and process control. It sounds technical, but can mean millions and millions of dollars saved in the production processes. For example, a $4 million commitment to this program is being made by American industry through the American Society for Metals.

I have already entered into the Congressional Record my assessment of the importance of this joint industry-Government venture. But the reason industry pooled its resources in the first place was the leadership of the National Bureau of Standards, and they should be commended for that leadership.

Future productivity and competitiveness of the minerals and materials industry, including vulnerability to foreign imports, depends on our response to national problems. The high cost of energy, lagging productivity, and higher than competitive—in terms of world competition—labor costs, uncertainty in market forces, increased competition from foreign manufacturers, and rapidly-changing Third World politics—together, these forces present pressures and opportunities that impact on hundreds of thousands of basic manufacturing industry jobs, particularly in the Northeastern and Midwestern States, and particularly in my own District, which is the home District of the Bethlehem Steel Corp., and the State of Pennsylvania, basically the largest steel-producing State in the country.

It is through the development of improved materials processing techniques, new materials and more competitive products containing advanced materials that we can boost lagging U.S. productivity and jobs across a broad spectrum of metals technologies that affect our national prosperity and security.

I flat out reject the approach of certain people promoting high-tech who say goodby to the smokestack industries. They are misunderstanding the basic impact of high technology in this society, and that is to infuse each and every one of those, where possible, basic industries with the high technology that will allow increased productivity and the regaining of competitive edge.

For example, in my field of metallurgy, rapid solidification processing offers an array of new cost-effective products and processes resulting in improved properties such as strength, corrosion resistance, ability to shape. Rapid solidification can also play a crucial role in development of alloys to reduce our dependence on imports of cobalt, chromium, tantalum and other critical elements.

Rapid solidification technologies will have significant impact on the conservation and substitution of those strategic materials. For

example, imported chromium is used to limit the corrosion rate of steels. Cobalt and tantalum are used to provide heat resistance to jet engine turbine alloys. By providing alloy modification beyond current capabilities, rapid solidification can enable the use of substitute elements for many of the same purposes.

The National Bureau of Standards' role in the crosscurrent of technology productivity in defense is clearly defined in their leadership of materials programs, both the Bureau's programs and wider Federal efforts in materials, especially as coordinated by the Committee on Materials, COMAT. The program is recognized as being among the best goal-oriented R&D programs in the world.

It includes a generation of basic scientific information data and measurement techniques and the development of a comprehensive computerized data base for alloy design for use by Government and industry.

Now, industries view the importance of this data base as evidenced by their own $4 million commitment. A cooperative program on steel-sensored technology with the AISI, the American Iron & Steel Institute, is another example of important collaboration.

I have been pleased to follow Dr. Mehrabian's leadership. Dr. Mehrabian is the Director of the Center for Materials Sciences at the National Bureau of Standards, of the Committee on Materials, of the coordination of rapid solidification technology in the past, and the current effort ongoing in welding materials.

Some people have written off welding, but if you take a look at the new computerized, robotized equipment along with new knowledge in the solidification technologies, and the science, we can regain world leadership in that field.

NBS leadership is providing glue for the kind of cooperative basic research the Administration has been promoting. The goal of bringing greater private-sector R&D resources to bear on problems is being met by collaboration between Government and the private sector.

But far more of this kind of collaboration needs to be done so that we are not simply, in this Congress, again building the storehouse of research and development for shelves in libraries. We are actually bringing these results out into the marketplace with products and sales, which mean American jobs.

And I thank the Chairman for the opportunity to be here today.

Mr. GLICKMAN. I thank my colleague from Pennsylvania. I believe that he probably has more expertise in this area than anybody else in Congress. As we strive to find responsible but corrective answers to a variety of materials issues which are probably the foundation of the future industrial strength of this country, I know that Mr. Ritter will be an active part of whatever legislative or oversight process that we as Members of Congress are involved in, so I hope you will be able to stay for a while as some of our witnesses testify.

Mr. GLICKMAN. We are pleased to welcome all three of you today. I think what I would like to do, if possible, is to have you all give your testimony and then we will question you as a panel. We will have Dr. Flemings' statement first, and then Bob Mehrabian's

second, and Rustum Roy's third. Afterward, we will have questions and answers.

I must mention that your entire statements will appear in the record. If you could summarize it would be much appreciated. The problem here in Congress, is that we always try to get everybody else to summarize and then when you listen to us on the House floor, we never summarize. So it is kind of do as we say, not as we do, but I hope you will do your best to cooperate.

So, Dr. Flemings, why don't you go ahead and begin.

STATEMENTS OF DR. MERTON FLEMINGS, HEAD, DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY; DR. ROBERT MEHRABIAN, DIRECTOR, CENTER FOR MATERIALS SCIENCES, NATIONAL BUREAU OF STANDARDS; DR. RUSTUM ROY, BROOKINGS INSTITUTION

Dr. FLEMINGS. Thank you, Mr. Chairman, Congressman Ritter.

I am Merton Flemings, professor and head of the Department of Materials Science and Engineering at MIT. I am pleased to be here today to present my views on national needs and opportunities in high technology materials R&D, and to give my views on the direction and stimulation required to lead the Nation's materials industry into the next decade of intense international competition.

I do not need, especially here, to describe in any general way how intense that competition has become in selected industries such as automotive and consumer electronics. Nor how intense it is becoming in industries such as aircraft and computers.

But I want, instead, to turn directly some specific technological examples, some examples of materials developments that we can certainly expect. There is some uncertainty as to exactly when we will see these developments that I will mention, and greater uncertainty as to whether they will be exploited first here in this country, or abroad.

But there is a high degree of certainty that we will see most of them.

In 1959, the maximum number of transistors on a semiconductor chip was one. Today, it is a few hundred thousand, and the first figure in the outline of my testimony that you have has logarithmically linear figure, and we are all familiar with the information revolution that this change has caused.

This logarithmically linear trend has not come to an end, and it will continue on for about three order of magnitude more until we have 100 million transistors on a single chip. But this growth of complexity depends on results of materials research and development. We need materials of higher perfection, we need new low-temperature processing techniques, new techniques and new materials for doping these semiconductors, new ways of connecting in and out of them.

Who will be there first? Us or our competitors? The stakes are very high. We will soon be looking beyond this conventional planar silicon technology to 3D integration and to newer, faster types of semiconducting materials.

The developments in this area are held back today not by our understanding of electronics, but by our knowledge of materials and of materials processing.

Today, America has the finest telecommunications in the world. Our system leads in so many areas, and most recently has taken another great step forward with the development of fiber optics.

Laser light transported in tiny glass fibers is beginning to replace electric currents in copper at enormous savings in cost and efficiency. We can be proud when we read today that fiber communications are being installed in our Northeast Corridor, and with 30,000 miles and more of tiny glass fibers between here, Washington and New York, and that each of those fibers can transmit the equivalent of the complete Encyclopaedia Britannica in only 1 minute. And this is only the beginning.

In order to maintain our lead in telecommunications, to reduce its cost, to permit computers to talk to one another efficiently, we need better semiconductors, and we also need better light carriers, better fibers.

Today, for example, we need expensive repeaters in these fiber communications every few dozen miles, because of absorption of light by the glass. When we learn to alter this absorption frequency in a practical way, we will be able to transmit light at wavelengths approaching 3 microns instead of the 1.3 today, and then we will be able to eliminate the bulk of the expense in the long-distance telecommunications systems, namely these repeaters.

And at that time, we will be able to look forward confidently to the virtual replacement of copper by glass for information transfer.

Then when we develop materials to transmit light with low loss at still higher wavelengths, say 10 microns, we will be making a qualitative difference in the efficiency and the effectiveness of many devices and instruments, ranging from infrared detection devices to compact, economic lasers that can be readily manipulated for use in surgery, miniature welding, and in hole-drilling operations.

I agree completely with Congressman Ritter and his point that we cannot neglect our smokestack industries in this country. And I agree with Dr. Ed David, now of Exxon, who says that if we are to retain these basic industries, such as our basic materials producing industries, we must blur the distinction between these industries and the newer, high-tech industries.

Modern electronics and modern electronic materials comprise one of our tools to do this. Congressman Ritter has already mentioned the National Bureau of Standards, and I will use them as one example, one of many examples.

That is the joint effort by NBS and the Department of Energy and the American Iron and Steel Institute to develop a sensing device based on laser and fiberoptic technology to directly measure chemical composition of molten steel at its temperature of about 3,000 degrees, Fahrenheit.

Utilization of just this device would save the industry somewhere in the range of $200 million annually in operating and energy costs. Two other sensors are also being developed jointly by AISI and NBS that have equally great potential impact.

I could cite many other examples in this traditional field. One is the strip casting process, which, combined with in-line rolling to product steel sheet for automotive and other applications, will result in major energy savings and major cost savings, and perhaps, most importantly of all, has the potential to produce steel of higher quality and improved properties and better formability than the steels we have today.

The rewards to the country that first develops this strip casting process will be very great.

The aluminum industry, like the steel industry, will be facing great difficulties in the coming decade. Major issues facing it are high capital and electrical energy costs, dependence on imported petroleum for anode coke, and of course, tightening environmental controls.

The high cost of capital and the costs and shortages of electrical energy and petroleum coke will force smelters in the United States to expand only incrementally to meet domestic needs.

To maintain an economically viable domestic aluminum industry, new technology must provide the means to increase productivity, to improve energy efficiency, to provide a substitute for petroleum coke and to solve environmental problems.

And a cornerstone of that new technology will, we can all now hope, be inert electrodes for the electrolytic reduction process. Such electrodes would have a great impact on productivity, energy efficiency and pollution and would eliminate the need for petroleum coke.

Energy savings could be at as much as .02 quads, where the total energy consumption in the entire country is 85 quads, 5 of which are involved in the production of steel and aluminum, and not inconsiderable savings.

There are many other ways in which materials processing developments can help reduce these 5 quads still further. Another example of an important developing product area that Dr. Mehrabian will also talk about is steel used the core of electric power transformers.

Our current annual loss of energy and power transformers is 50 times 10 to the ninth kilowatt hours, or equivalent to about $2.75 billion annual cost.

Improvements in existing crystalline silicon sheet steels such as those made so well today in the Pittsburgh area could certainly reduce this loss by 30 percent, and new amorphous metal sheet materials have the potential to reduce it by as much as 50 percent.

Another area where technology can be of enormous benefit to the country is in the area of corrosion. Corrosion consumes 4 percent of the gross national product, or about $120 billion annually, in the form, for example, of rusting of automobiles and deterioration and replacement costs of the country's infrastructure.

Twenty-five percent, certainly, of this total, could be saved by better transfer of today's technology, and another 25 percent is there to be saved by developing and applying modern materials and materials processing technologies to new types of coatings and surface treatments.

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A concommitant advantage in such developments would be the reduction in the need of critical materials that are now used in such great quantities for corrosion protection.

Turning to the aircraft industry, we have been the world leader for so long in development and production of aircraft that we find it hard to believe that America is now facing a potential loss of this commanding lead to overseas competition.

If we are to retain a strong aircraft industry, materials and materials developments will play a key role. One simple example you will hear more about later, is that of composites and rapidly solidified materials which have the potential to lower aircraft weight and improve its performance efficiently to give our industry a major competitive edge.

I have cited an example in the text which I will not go into here which indicates that applying this technology could result in the savings of over $1 million per year per flying aircraft.

But these lightweight materials, including composites and newer steels and magnesium have begun also to have their impact on the automobile industry. The potential impact of these materials on fuel economy has been well-documented, and could result in savings in excess of 20 percent of today's oil consumption.

But we must now be especially attentive to another advantage of these new materials. They provide the opportunity to produce longer-lasting, more reliable, lower-cost, peppier automobiles with great design flexibility.

In short, they can be a powerful factor in helping us gain a competitive advantage or slip further behind. None of us in the materials field were very surprised to read that Toyota has developed and put into production the first commercial application of metal matrix technology.

But we believe it is vital that we, in this country, catch up and pass our competitors in this and in other new materials technologies for automotive applications.

Nowhere is the competition with the Japanese more evident than in modern ceramic technology. There is still, today in the United States, only a weak industry in high technology ceramics, while the Japanese have made a major commitment to be the world's major source of these materials.

I have a table in the text which I also will not put on the board, which indicates the commanding lead that the Japanese have in a variety of these high-technology ceramic areas, including ceramic powders, electronic packages, capacitors, and so on.

The Japanese share of the market is large and growing. New uses will be found for these materials in ceramic engines, ceramic ball bearings, new cutting tools, new electronic materials, and many other areas.

It has been estimated that as this market grows, and when ceramics come of age, in terms of meeting certain specific properties that are also listed in the text, an instant ceramics market of an additional $5 billion will become immediately available.

But more importantly, important businesses in this country worth $50 billion will become obsolete unless they quickly adopt that technology or purchase and use components made by the technology.

Mr. GLICKMAN. Dr. Flemings, do you think we could ask you to summarize?

Dr. FLEMINGS. Yes, I would be happy to.

I will now, not only summarize, but I will go very quickly to—I will skip the rest of the examples that I had planned to give, not very many of them, but I will skip the few remaining examples and go directly to my recommendations, my thoughts as to what should be done.

Besides the recommendations, I was only going to list the outline of what the MITI program is, but you all know that well.

I was going to indicate that the technical examples that I had been giving you are not just the dreams of visionaries, but the benchmarks by which we will be measuring our competition, and our competitive position, vis-a-vis the Japanese and others in the decade ahead.

The Japanese, of course, are clear in their course, as indicated by that MITI program.

But what now should we do? Clearly, we should build upon our strengths, our strong university research system, our strong and growing university-industry-government relationship, and our talent for innovation and entrepreneurship.

And we must recognize that inevitable as are the revolutionary materials developments I have been discussing, they will not happen by themselves, and they will not necessarily happen first in the United States.

They will come about through technology-oriented research programs. That is, programs oriented towards clear technological process or product performance objectives. The programs, at their best, will include development of a deep fundamental understanding of the science of the material, and the science of the processing, and they will range in scope from this point to formulation of practical methods for the reliable production of materials.

That is, programs focused toward clear, technological process or product objectives.

I have a paragraph following summarizes the important developments that have come—or the important initiative that came out of ARPA, now DARPA, a number of years ago, setting up what we call materials research laboratories, or MRLs, in this country.

These MRLs have been important, and continue to be important, but I believe the time has now come when we need new groupings of faculty in universities, working more closely with industrial and government laboratories, and working on technology-oriented programs, such as those I have been discussing in the preceding examples.

I believe the Government should and could play a key role in instigating and fostering such groupings. If I may, then, I will summarize five specific recommendations.

First, I believe we should recognize that limitations of materials and materials processing represent today's engineering limitations for a wide range of engineering structures, devices and machines.

We should develop more focused, coherent programs to deal with these limitations, funded as part of the clear plan with continuity.

Second, we should develop new methods for strengthening, broadening, and deepening education in materials science and engi-

neering. The field has been in existence only about two decades, and in that time, the education given students in the materials field has changed dramatically, and the fruits of that change are being seen today in the creativity, the versatility and the productivity of those graduate materials scientists and engineers now in industry.

The COSMAT report, Materials and Man's Needs, written in 1974, is the outgrowth of the National Academy of Sciences' study, chaired by Prof. Morris Cohen, had much to do with the last decade of change in materials science and engineering.

It is time for another such study, and for the innovations that such a study would facilitate.

My third recommendation is that we should develop mechanisms for strengthening research on the fundamental science and the engineering of materials processing, both to produce new materials, new advanced materials with new properties, and to produce today's materials, machines and devices, with improved reliability, with lower cost, and with lower use of strategic materials.

Fourth, we should strengthen and improve university-industry-government relations in the materials field in such a way as to foster basic studies on advanced materials and on advanced materials processing.

To focus these studies toward areas of greatest technological promise, to promote technology transfer and to foster entrepreneurship.

Fifth, and lastly, I believe we should establish specific new groups of faculty and universities, working closely with industrial and Government laboratories on technology-oriented problems, on aspects of these problems, ranging from development of a deep, fundamental understanding of the science of the material and of its processing to the formulation of practical methods for reliable production of the material.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Flemings follows:]

Statement on

Technology Oriented Materials Research and Development

Professor Merton C. Flemings
Head, Department of Materials Science and Engineering
Massachusetts Institute of Technology

before the

Committee on Science and Technology
Sub Committee on Transportation, Aviation, and Materials

U.S. House of Representatives

May 19, 1983

Mr. Chairman and members of the Committee, I am Merton Flemings, Professor and Head of the Department of Materials Science and Engineering at M.I.T. I am pleased to be here today to present my views on national needs and opportunities in high technology materials R&D, and to give my views on the direction and stimulation required to lead the Nation's materials industry into a decade of intense international competition.

I do not need to describe in a general way how intense that competition has become in selected industries such as automotive and consumer electronics, nor how intense it is becoming in industries such as aircraft and computers. Rather let me turn directly to some specific technological examples - some examples of materials developments that we can certainly expect in the not very distant future. There is some uncertainty as to exactly when we will see these, and greater uncertainty as to whether they will be exploited first here or abroad but there is a high degree of certainty that we will see most of these I list.

In 1959 the maximum number of transistors on a semiconductor chip was one. Today it is a few hundred thousand, Figure 1, and we all are familiar with the information revolution this has caused. This logarithmically linear trend will continue for about three more orders of magnitude, until we have 100 million tiny transitors on a single chip. But this growth of complexity depends on, and is limited by, results of materials research and development. We need materials of higher perfection, new low temperature processing techniques, new techniques and materials for doping and for conductors. Who will be there first? Us or our competitors? The stakes are very high.

And we will soon be looking beyond conventional planar silicon technology to 3D integration and to newer, faster materials such as those of GaAs family. These developments are held back today not by our understanding of electronics

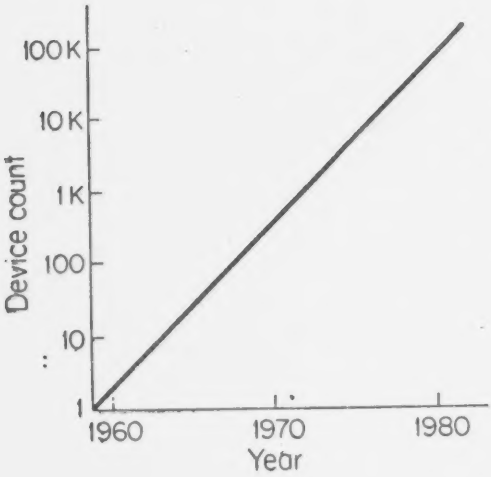

Figure 1

Complexity trend of experimental integrated circuits since the invention of the planar process in 1959. The vertical axis shows the number of transistors or transistor sites per chip.

From P. L. Penfield Jr. "Small's Big: The Microelectronic Challenge", M.I.T., 1982.

but by our knowledge of materials and materials processing.

Today, Mr. Chairman, America has the finest telecommunications network in the world. Our system leads in so many areas - and most recently has taken another great step forward with the development of fiber optics. Laser light transported in tiny glass fibers is beginning to replace electric currents in copper - at enormous savings in cost and in efficiency. We can be proud when we read that fiber communications are being installed in the northeast corridor, with 30,000 miles of tiny glass fibers between here and New York - and that each fiber can transmit the equivalent of the complete Encyclopedia Brittanica in one minute.

In order to maintain our lead in telecommunications, to reduce its cost, to permit computers to talk to one another efficiently, we need both the smaller electronics discussed above and we need better light carriers, better fibers. Today, for example, we need expensive repeaters every few dozen miles, because of absorption of light by the glass. When we learn to alter the absorption frequency of glass so we can transmit light of wavelengths approaching three microns (instead of the 1.3 microns used today) we will be able to transmit thousands of miles without repeaters, thus eliminating the bulk of the expense in long distance telecommunications systems. And we can then look forward confidently to the virtual replacement of copper by glass for information transfer.

When we develop materials to transmit light with low loss at still higher wavelengths, say 10 microns, we will make a qualitative difference in the efficiency and effectiveness of many devices and instruments, ranging from infra-red detection devices to compact, economic lasers that can be readily manipulated for use in surgery, miniature welding and hole drilling operations.

If we are to retain our basic industries, such as our basic materials producing industries, we must blur the distinction between these industries

and the newer "High Tech" industries. Modern electronics and modern electronic materials comprise one of our tools to do this. One of many examples is a joint effort of the Department of Energy and the American Iron and Steel Institute to develop a sensing device based on laser and fiber optic technology to directly measure chemical composition of molten steel at its temperature of about 3000°F. Utilization of this device alone would save the industry somewhere in the range of 200 million dollars annually in operating costs and energy costs.

Another example of new technology in this traditional field is the potential development of a strip casting process combined with in-line rolling to produce steel sheet for automotive and other applications. It is estimated that such a development would save the country 10^{15} BTU'S or 0.1 "Quads" of energy per year. This development also has the potential for lowering costs, and perhaps most importantly to produce steel of higher quality and improved properties that would be more competitive at home and abroad.

The aluminum industry, like the steel industry, will be facing great difficulties in the coming decade. Major issues facing it are high capital and electrical energy costs, dependence on imported petroleum for anode coke, and tightening environmental controls. The high cost of capital and the high costs and shortages of electrical energy and petroleum coke will force smelters in the U.S. to expand only incrementally to meet domestic needs. To maintain an economically viable domestic aluminum industry, new technology must provide the means to increase productivity, improve energy efficiency, provide a substitute for petroleum coke, and solve environmental problems.

A cornerstone of that new technology will, we can all now hope, be inert electrodes for the electroyltic reduction process. Such electrodes would have a great impact on productivity, energy efficiency and pollution; they would also eliminate the need for petroleum coke. Energy savings could be

up to 0.2 quads. The production of steel and aluminum combined, incidentally, consumes 5 of the total 85 quads of energy used annually in the United States. There are many other ways in which materials processing developments can help reduce this 5 quads still further.

Let me cite also an example of an important developing product area for specialty steels, those steels used in the core of electric power transformers. Our current annual loss of energy in power transformers is 50 x 10^9 kilowatt hours, equivalent to about a 2 3/4 billion dollar annual loss. Improvement in existing crystalline silicon sheet steels could certainly reduce this loss by 30% and the new amorphous metal sheet materials have the potential to reduce it by 50%.

Corrosion in this country consumes 4% of the gross national product, or about 120 billion dollars annually - in the form, for example, of rusting of automobiles, and deterioration and replacement costs of this country's infrastructure. Twenty-five percent of this total could be saved by better transfer of today's technology and at least another 25% is there to be saved by developing and applying modern materials and materials processing technologies to new types of surface coatings and surface treatments. A concomitant advantage in such developments would be the reduction in need of critical materials now used in great quantities for corrosion protection.

We have been the world leader for so long in development and production of aircraft that we find it hard to believe that America is now facing the potential loss of this commanding lead to overseas competitors. If we are to retain a strong aircraft industry, materials and materials development will play a key role. Let me give one very simple example. New materials, primarily composites and rapidly solidified materials have the potential to lower aircraft weight and improve its performance sufficiently to give our industry a major competitive edge. For example, the structure of a Boeing 747 weighs about 210,000 pounds. Projections indicate that it should be possible to

reduce this weight by nearly 50,000 pounds through use of advanced composites and other new materials, with a resulting annual savings from lower fuel costs alone approaching one million dollars a year. But much materials research and development must be done to bring these materials, especially metal matrix composites, to the point of this broad application.

Lightweight materials - including composites, newer steels, and magnesium have begun also to have their impact on the automobile industry. The potential impact of these materials on fuel economy has been well documented and could result in savings in excess of 20% of today's U.S. oil consumption. But we must be especially attentive today to another advantage of these new materials. They provide the opportunity to produce longer lasting, more reliable, lower cost, peppier automobiles, with greater design flexibility. In short they can be a powerful factor in helping us gain a competitive advantage - or slip further behind. None of us in the materials field were too surprised to read that Toyota has developed and put into production the first commercial application of metal matrix technology, but we believe it is vital that we in this country catch up and pass our competitors in this and in other new materials technologies for automotive applications.

Nowhere is the competition with the Japanese more evident than in modern ceramic technology. There is still today in the United States only a weak U.S. industry in high technology ceramics while the Japanese have made a strong commitment to the major world source of these materials. It has been estimated that if the supply of multilayer aluminum substrates from Japan as carriers for silicon chips were interrupted, the U.S. would be left with a mere three day's supply (75% - 85% of our domestic business is owned by two Japanese companies).

Table I illustrates the commanding portion of the world market of high technology ceramics the Japanese now have. But this is only the beginning.

TABLE I *

1980 HIGH TECHNOLOGY CERAMICS MARKETS

Product	M$ Sales Japan	M$ Sales Worldwide
Ceramic Powders	130	250
Electronic IC Packages/Substrates	540	880
Capacitors	325	750
Piezoelectrics	295	325
Thermistor/Varistors	125	200
Ferrites	380	480
Gas/Humidity Sensors	5	45
Translucent Ceramics	20	45
Cutting Tools	125	1,025
Structural Ceramics	120	250
	$2,065M	$4,250M

* From H. K. Bowen's "High Technology Ceramics in Japan: Current and Future Markets" Bulletin of the American Ceramic Society, May 1983

The Japanese share appears to be increasing and the market is growing. New uses will be found for these materials in ceramic engines, ceramic ball bearings, new cutting tools, new electronic materials and in many other areas. It has been estimated, for example, that when structural ceramics come of age, in terms of meeting some specific properties listed in Table 2, an instant ceramic market of $5 billion will become available, and more importantly businesses worth $50 billion will become obsolete, unless they quickly adopt the technology or purchase and use components made by the technology.

I want now to give just one example from a very different field that has great commercial implications, but even greater implications for human health and well being. The field is biomaterials and the example is artificial skin. Each year 130,000 people are hospitalized in the United States from burns, some 10,000 of them die, and many are permanently disfigured. Synthetic skin today offers the best hope for saving those who now die, and for preventing disfigurement.

A development now emerging from materials science and engineering that shows great promise is composite synthetic skin made of silicone and collagen that is bioreplaceable; i.e., that serves as a template or catalyst for growth of new skin, and then is replaced by that skin. In addition to this short example, there are hundreds of others I could cite in this field that is so important nationally, and to each of us personally.

The technical examples I have given above are far from the dreams of visionaries. They are benchmarks by which we will be measuring our competitive position vis á vis the Japanese and others in the decade ahead. The Japanese have no doubt about their course in this regard. The now well known MITI funded program "Next Generation Industry" has materials research and development as its main and central theme, and its topics are focussed

TABLE II*

If structural ceramics were available with reproducible, reliable manufacturing and:

- cost $3-10/pound
- K_{IC} 10-20 ($MPam^{1/2}$)
- Use range 800-1300°C
- σ_f 75-150 ksi

The result would be:

- An instant ceramics market of $5B
- Businesses worth >$50B would be in danger of obsolescence.

* From H. K. Bowen

towards a series of clear, technological process or product performance objectives, including most of those I have used as examples. Table III is a brief outline of that MITI ten year research program.

And what should we do? Clearly we must build upon our strengths - our strong university research system, our strong and growing university-industry-government relationship, our talent for innovation and entrepreneurship and we must recognize that inevitable as are the revolutionary materials developments I have been discussing, they will not happen by themselves, and they will not necessarily happen first in the United States. They will come about through technology oriented research programs; i.e. programs that are oriented towards clear technological process or product performance objectives. These programs, at their best, will include development of a deep fundamental understanding of the science of the material and the science of its processing. And they will range in scope from this point to formulation of practical methods for reliable production of the material programs; i.e., programs that are focussed towards clear technological process or product objectives.

In the 1960's the Advanced Research Projects Agency, now DARPA, initiated at a number of universities centers for excellence in materials which came to be known as the Materials Research Laboratories, MRL's. These laboratories have, at most of the universities where they were established, brought together materials faculty and students from several disciplines including materials science and engineering, physics, and chemistry - to work on materials problems which have been usually of a quite fundamental nature. The laboratories, now supported by NSF have fulfilled a vital function in helping develop and mold materials science and engineering as we know it today, and they continue to play a significant role at many universities including my own in providing critically important central research facilities,

TABLE III

MITI "NEXT GENERATION INDUSTRY"

1. Fine Ceramics

   Develop Ceramics with Improved Toughness, Strength, Anticorrosion and Antiabrasion Properties

2. Materials for Membrane Technology

   To Improve Separation Technology and Energy Efficiency in the Chemical Industry

3. Electro-Conductive Polymers

   To Achieve New Electrical or Electronic Properties

4. High Crystalline Polymers

   Develop New Polymers Having Comparable Mechanical Properties to Metals for Structural Applications

5. High Performance Crystalline Controlled Alloys

   "Single Crystal" Superalloys; Superplastic Forming, Strip Casting of Steel

6. Composite Materials

   High Performance Metal and Polymeric Matrix Composites

7. Bioreactors

8. Cell Mass-Culture

9. Recombinant DNA Applications

10. Superlattice Elements

    Materials and Processes, Superlattice Elements in Semiconductor Thin Films

11. Three Dimensional Circuit Elements

    Multi-Layer VLSI

12. Enforced Environment-Resistant Elements

    Element, Packaging, and Integration Technology for Severe Environments

and in funding of fundamental materials studies.

But I believe the time has now come when we need new groupings of faculty in universities, working more closely with industrial and government laboratories, and working on technology oriented problems such as I have described above. Industry and government could and should play a key role in instigating and fostering such groupings.

I would like, Mr. Chariman, to conclude with five short recommendations based on my general remarks above. These are as follows:

(1) We should recognize that limitations of materials and materials processing represent today's engineering limitations for a wide range of engineering structures, devices, and machines - in terms of performance, cost, and reliability. We should develop more focussed, coherent programs to deal with these limitations, funded as part of a clear plan, with continuity.

(2) We should develop new methods for strengthening, broadening, and deepening education in materials science and engineering. The field of materials science has been in existence only about two decades, and in that time the education given students in the materials field has changed dramatically. The fruits of that change are being seen today in the creativity, versatility, and productivity of the graduate materials scientists and engineers now in industry. The COSMAT Report "Materials and Man's Needs", written in 1974 as the outgrowth of a National Academy of Sciences study, chaired by Professor Morris Cohen, had much to do with the last decade of change in materials science and engineering, and particularly with its educational component. It is time for another such study and for the innovations that such a study would facilitate.

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(3) We should develop mechanisms for strengthening research on the fundamental science and engineering of materials processing - both to produce new materials with new properties, and to produce today's materials, machines and devices with improved reliability, lower cost, and lower use of strategic materials.

(4) We should strengthen and improve university-industry-government relations in the materials field in such a way as to foster basic scientific studies on advanced materials and on advanced materials processing, to focus those studies toward areas of greatest technological promise, to promote technology transfer, and to foster entrepreneurship.

(5) We should establish specific new groupings of faculty in universities working closely with industrial and government laboratories on technology oriented problems - on aspects of these problems ranging from development of a deep fundamental understanding of the science of the material and the science of its processing to the formulation of practical methods for reliable production of the material.

Mr. GLICKMAN. Thank you very much, Dr. Flemings.

Now, Dr. Mehrabian, it is a pleasure to have you here today. You may proceed.

Mr. MEHRABIAN. Thank you, Mr. Chairman.

It is a pleasure to be here, Mr. Chairman and Congressman Ritter. I have provided a lengthy statement, which I believe will be in the record.

Mr. GLICKMAN. Yes, your entire statement will appear in the record.

Dr. MEHRABIAN. What I would like to do now is to read a paragraph from the statement, and then give some examples of the implementation of materials processing technology that I brought with me. Using one or two of these examples I will be able to describe special COMAT university-industry-government programs that are assisting American exploitation of advanced technologies.

The emphasis of my testimony will be on advanced processing of materials. That includes the synthesis of high-performance materials such as likes the ones you have on the bench there. Under the advanced processing banner I want also to take up something that Congressman Ritter noted and Professor Flemings emphasized, the application of advanced processing to our basic industries.

I will then use these examples, as I have indicated, to describe successful, coordinated efforts that are being carried out now in this country for advanced materials and technologies.

Let me start with rapid solidification. It is an area that both Congressman Ritter and Professor Flemings have referred to. I would like to start with that first display on the right-hand side, if I may.

That is a display put together from a program at Pratt & Whitney Aircraft. On the left side of the display, there are some very fine powders. Those powders are produced by rapid cooling of a liquid alloy stream by a helium gas jet. The process was developed in 1976.

Just below the powders on the display is an advanced turbine blade that was put together from those very fine powders. The turbine blade demonstrates several important characteristics of this technology. First, the blade has an operating temperature that is 150° higher than the best conventional turbine blades that are used. Second, the blade incorporates very fine passages for cooling. It was tested in the F-100 engine, which powers the F-16 and F-15 aircraft. That 150° operating temperature increase demonstrates the potential for increasing the turbine inlet temperature, by 600° F., which of course leads to improved fuel efficiency.

A more dramatic example is shown by the two rods that are located right next to the blade. The rod on the left side is a conventional rod. It is usually coated for use in a turbine engine. The rod on the right was made from a new rapidly solidified alloy. It was not coated. Both rods were subjected to 2200° F., for 300 hours. You note the shiny surface of the rapidly solidified rod, and can compare it with the corroded, oxidized surface of the other.

Next to these is a turbine vane that is a single crystal also made from rapidly solidified material. It is anticipated that in the next generation of engines, such material would be used uncoated. The shroud next to it is another part of the turbine that is used.

Now, the success of this program, Mr. Chairman, comes not only from developments at Pratt & Whitney Aircraft. It is a joint program, a government-university-industry program. It is coordinated through COMAT, the Committee on Materials, which has a specific Task Group on Rapid Solidification.

The coordination was carried out as follows: First, the Government agencies got together and reviewed their rapid solidification projects. Second, we invited the private sector to a workshop on that subject. We presented the various government programs to the private sector, and the private sector then made recommendations on implementation of these programs.

Since 1981 when this occurred, we have successfully implemented a number of those recommendations. For example, we have now carried out a survey through the National Academy of Sciences that outlines every single facility for rapid solidification that is available in the country that can be mobilized and used in this new technology.

In addition, we have developed a special facility at NBS to supply those firms that can't afford to put their own rapidly solidified materials together, but would like to test them on their product lines. It is available to them. They send their own scientists to NBS to make samples and carry them back.

Third, our phase diagram program was mentioned by everybody. That is a program that evaluates road maps for design of alloys. These diagrams are being made available to industry and include special ones for design of new alloys for this field.

Let me now just mention the second display up there, which also relates to rapid solidification. The structures that you have in your hand now are crystalline materials. Usually, 99.9 percent of the metals you see are composed of atomic structures that repeat themselves in a crystalline manner. However, certain alloys, when they are frozen very, very rapidly, can form amorphous structures, that is random atomic structures. The wide foil that you note—the 6½-inch foil—which is a magnetic foil, was developed at Allied Chemical. It is a rapidly solidified material and is the material that Professor Flemings referred to for transformer cores. It can be magnetized and demagnetized with very little use of energy, and therefore, can cut use of electricity significantly. It has been estimated that use of this foil in transformer cores, could result in a saving of $1.5 billion. The other two foils are braising alloys that are also rapidly solidified. I won't go into details concerning them now.

I have other examples on the table that we can talk about later, if you wish, but I want now to move on.

I would like to go to my third topic, which was application of new technologies to our basic industries. I would like to give two very brief examples.

First, the steel industry, which has been referred to now, has developed a program to provide for their sensor needs. They first identified 537 sensors in approximately 35 steel processes. These are sensors that look at a steel process, indicate whether it is doing the right thing, whether the process is providing the right structure. Then the sensor feeds back into the system and controls it, so that the first time the product is made, it is a high-quality product.

Out of all of those 500 sensors, the industry chose four top ones. Then we, in conjunction with American Iron and Steel Institute and the Department of Defense, held a workshop on these sensors. I have a report of that workshop here, which I will submit for the record.

Out of that workshop came the developments that Professor Flemings has mentioned. The Department of Energy is embarked on developing one of those sensors, and at the National Bureau of Standards are working with the steel industry and some of their scientists, who will be working in our labs, on development of two of the sensors.

An example of one sensor equipment is a large steel ingot for which the industry needs to determine the temperature distribution inside. We hit the surface of the ingot with an energetic laser beam, and measure the time it takes for that laser energy to go through the ingot. We combine that information with the type of tomography that is used in CAT scans in generating pictures of the brain, for example. We then use such information from this advanced technology to develop complete temperature distributions inside the steel ingot.

Finally, I would like to mention briefly the welding activity. This is under a new Comat Subcommittee that has been assigned to coordinate the activities in welding research in the United States.

In this coordination activity, which I chair, the first order of business was to determine what the various programs were in the Government; then to couple those programs with industry. We invited industry representatives to attend a workshop on the subject. That workshop, I think, was mentioned by Dr. Keyworth 2 days ago. It set, essentially, the R&D priorities in welding and welding implementation technologies in the country. We are now in the process of implementing those recommendations.

Mr. Chairman, that concludes my presentation.

Thank you.

[The prepared statement of Dr. Mehrabian follows:]

U.S. Department of Commerce

Statement of Robert Mehrabian

Director, Center for Materials Science

National Bureau of Standards

before the

Subcommittee on Transportation, Aviation, and Materials

of the

Committee on Science and Technology

U.S. House of Representatives

on

High Technology (Advanced) Materials

May 19, 1983

Mr. Chairman, Members of the Subcommittee:

I thank you for this opportunity to meet with you today to discuss high technology (advanced) materials.

INTRODUCTION

The emphasis of my testimony will be on advanced processing of materials. It will include the synthesis

of high performance materials such as rapidly solidified metallic glasses and high temperature turbine alloys, advanced ceramics, polymer blends, and composites. I also want to introduce, under the advanced processing banner, the infusion of advanced technologies into our basic materials industries to improve quality and productivity. As examples, I will describe the use of advanced processing in steelmaking and in welding. Finally, I will stress the need for coordination of available resources; people, funds, and facilities, within the university/industry/government communities in priority technical areas of national concern. As examples and model systems, I will describe the present coordination of national programs in rapid solidification processing and welding in which I am heavily involved. These activities are carried out under the auspices of the Office of Science and Technology Policy (OSTP) Committee on Materials (COMAT).

ADVANCED PROCESSING OF HIGH PERFORMANCE MATERIALS

Let me first start with a short description of materials processing. Materials processing represents those combinations of operations which produce and shape materials, as well as control their internal

structures and their properties, so that they can perform effectively for societal use. For example, melting and casting of metallic alloys, often called solidification processing in modern times, is well-recognized as one of the historic kinds of materials processing, especially in the field of metallurgy.

Rapid Solidification Processing

For present purposes, we can use rapid solidification as the first example of advanced processing. The advent of this technology in the past few years has catalyzed new ideas across the wide spectrum of alloy structures, properties, and performance. A number of new advanced alloys and products have already emerged from this field. Rapid solidification also represents a technical priority area where national university/industry/government efforts are well coordinated, and where the U.S. enjoys a partial lead over its international competitors.

The important recent developments in rapid solidification have been the emergence of new processing technologies that permit achievement of fast cooling rates during solidification of small alloy droplets and the

production of thin continuous strips of metallic glasses. I have brought with me two displays which show the large range of properties and products that can be produced by these new processing techniques.

The first display is from Pratt and Whitney Aircraft of the United Technologies Corporation. The products are rapidly solidified alloy powders which can be consolidated to produce high performance parts in the next generation gas turbine engines. These parts could include lightweight aluminum fan stators, corrosion resistant bearings, oxidation resistant/lightweight burner inserts, and improved durability airfoils. In the Pratt and Whitney Aircraft Process (developed in 1976), tiny droplets of complex liquid alloys are rapidly solidified by spraying them into high speed jets of helium gas. The product is a fine crystalline powder which is very homogeneous in its internal structure when compared to the conventional state-of-the-art castings. Subsequent consolidation of these powders through advanced fabrication techniques has led to the new air-cooled radial wafer blade shown on the left side of this display. This experimental air-cooled wafer blade has already been tested in the Pratt and Whitney Aircraft F-100 engine, which powers the F-15 and F-16 aircraft.

This blade is made from a new rapidly solidified alloy with a 150 °F improved metal operating temperature over the strongest blades operating in the F-100 production engine. This coupled to the optimized cooling design developed in the radial wafer configuration offers the potential of increasing turbine inlet temperatures by 650 °F in the next generation of advanced engines. The higher operating temperatures will lead to improved fuel consumption and increased thrust to weight ratios. On the other hand, some of the temperature gain can be sacrificed for significantly increased turbine durability.

A more dramatic example from this advanced processing technology is depicted in the two bars in the center of the display. The bar on the left is the directionally solidified Mar-M-200 alloy used in current F-100 turbine blades. It was coated before the test. The next bar is a new rapidly solidified alloy which was developed at Pratt and Whitney Aircraft to improve oxidation resistance of blade alloys. It was not coated. Both bars were cyclically subjected to a temperature of 2200 °F for 300 hours. Note the significant loss of material in the conventional alloy versus the shiny (undamaged) surface of the new rapidly solidified material.

The vane sample is produced from another new oxidation resistant alloy that will not require coating. This part is a single crystal. Finally, the shroud on the extreme right is located on the outer periphery of the first stage turbine in the F-100. This new rapidly solidified alloy part was tested two weeks ago by Pratt and Whitney Aircraft for 910 cycles with performance vastly superior to the conventionally processed and coated components.

The program responsible for these developments was funded jointly by Pratt and Whitney Aircraft, the Defense Advanced Research Projects Agency and the Manufacturing Technology program of the Air Force. Supporting basic and generic research was carried out at a number of universities and government laboratories. It is a successful demonstration of a cooperative university/industry/government team effort that spans from fundamental scientific knowledge of processing to technology implementation.

The second display shows thin strips of metallic glasses produced at Allied Corporation and GTE Laboratories Incorporated. These ribbons result when a thin column of liquid is carefully brought into contact with a

spinning, watercooled wheel. The extremely rapid quenching of the molten alloys produces a non-crystalline, random atomic structure which is generally referred to as a metallic glass. Because of this random atomic structure, as opposed to the regular periodic atomic patterns obtained in conventional alloys, metallic glasses possess unusual properties. Among the most useful of these are exceptional magnetic properties, corrosion resistance and toughness. For example, the rapidly solidified metallic glasses produced by Allied Corporation are easily magnetized and demagnetized--they require much less magnetization energy than conventional transformer steels. Industrial tests have already shown that if all existing power distribution transformer cores were replaced with metallic glasses, an energy cost saving of approximately $1.5 billion per year would be realized.

Both the GTE and Allied Corporation brazing foils in the display also possess a random atomic structure. They are flexible and can be readily stamped into preforms of complex geometries for brazing (soldering) of high temperature nickel-base alloy components. These same alloys when subjected to conventional solidification are crystalline and extremely brittle. They require

more processing steps before use in either a paste or tape form, both of which consist of powders combined with organic binder. In some aircraft engine applications, these brazing foils replace gold based alloys resulting in dramatic cost reductions. Metallic glass brazing foils are also used to fabricate heat exchangers, metal honeycomb structures, and food processing equipment.

The national program in rapid solidification processing is well coordinated within the government under the Office of Science and Technology Policy (OSTP) Committee on Materials (COMAT). It combines effective utilization of resources in the university/industry/government communities. For example, in addition to several conferences on the subject, a Working Group of this committee under the chairmanship of Mr. Jerome Persh organized a Briefing/Workshop on July 1-2, 1981 at the National Bureau of Standards (NBS). The aims were first to provide the private sector (80% of the 275 attendees) with the government-wide implementation strategy in rapid solidification technology, and second, to seek university/industry input and involvement in order to effect a wider range of applications. A large number of private sector recommendations emanating from this workshop have now

been implemented into the government-wide program. These include: (1) the increased funding of priority research areas identified, including more work on phase diagrams*, ferrous alloys, and consolidation of rapidly solidified particulates; (2) the conduct and publication of a survey (conducted under the chairmanship of NBS) by the National Materials Advisory Board listing all available facilities in the U.S. for production and consolidation of rapidly solidified material, and the assessment of the adequacy of these facilities to meet the R and D needs and projected early industrial applications requirements; (3) the establishment of a state-of-the-art rapid solidification laboratory at NBS with cooperative research projects with 11 industrial and university laboratories in over 30 separate projects. This cooperation includes workers from other laboratories who come to NBS to produce research quality samples of rapidly solidified metals; and (4) incorporation of special thermodynamic information, useful for design of new rapidly solidified alloys, in the NBS computerized phase diagram programs. The latter is part of a larger

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*Phase diagrams are composition/temperature maps used in alloy design and control of metallurgical processes.

program between the American Society for Metals and NBS with industry providing $4 million to the project.

Advanced Ceramics

Ceramics have been used throughout history for low value-added applications such as bricks, tiles, refractories, abrasives, cements, glasses, and enamels. Today, however, I want to draw your attention to a new generation of advanced ceramics which has begun to provide the basis for sophisticated high technology uses in this country and abroad. Japan is now the source for one-half of global production of such materials.

Ceramics have attracted growing attention because the special properties that they offer are increasingly important to new technologies. Familiar properties such as high heat, wear, and corrosion resistance are essential to the performance of advanced systems operating under extreme conditions.

The third display shows research ceramic parts for truck and automobile engines. The efficiency of automobile, truck, and other heavy duty engines can be greatly increased through higher operating temperatures. These

temperatures are now limited by the durability of the materials of which they are made. Ceramics offer the chance to increase these temperatures very substantially, increasing fuel efficiency at least 30 or 40%. The partially stabilized zirconia coating on the cylinder section and the valve guide of solid stabilized zirconia are components of a diesel truck engine that operates without water cooling. The turbine components are for still more advanced engines for automobiles. To be considered here is not only the potential ceramics market but also the markets of user industries. Between 1985 and 2005, we understand that a successful U.S. ceramic engine program could add $280 billion to our gross national product. Lack of such a program could remove $110 billion from the economy over the same period. Several agencies are collaborating with the private sector in this area.

Also on the third chart are composite ceramic inserts of silicon nitride and titanium carbide for cutting tools from GTE Laboratories. They permit increased cutting speeds by a factor of two to three or more, and a ten-fold increase in cutting tool life for materials such as cast iron. The increases in productivity of machining operations by a switch to ceramics are thus

dramatic. Of course high speed machines must be acquired in order to realize these gains.

Other less familiar properties special to certain ceramics such as electrical insulating properties, high magnetic permeability, and special optical properties, are the heart of new high technology information systems. Thin film capacitors and integrated chip carriers are literally a basic part now of the electronics industry.

On the fourth chart are semiconductor chip carriers from IBM, which provide connections for integrated chips mounted on them. Some of these connectors go directly to pins to tie to other systems. Other connections tie one chip to another in a complex fashion requiring extremely sophisticated processing. The next target for this technology is to reduce the size of such an "integrated" carrier, but this reduction will mean development of other advanced ceramic materials.

In order to realize the potential in each of these new technologies, there are challenging scientific and technical problems to be solved. For example, the unpredicted catastrophic fracture of ceramics must be overcome. Furthermore, in order to capitalize on the

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special electrical, magnetic, and optical properties of advanced ceramics, we must develop a much deeper understanding of the generation and control of these properties. A central key to all of these areas is much improved materials processing. If we can learn to control the serious variability of ceramic products, which is built-in during processing, the major advantages potentially offered can be realized in fact.

I should note that this is an intensely competitive technology internationally. The Japanese alone, for example, have four national programs in advanced ceramics. They are being developed under the stewardship of the Ministry of International Trade and Industry, the Ministry of Education, and the Ministry of Science and Technology. The efforts of hundreds of scientists and engineers in national laboratories as well as many more in universities and in industrial laboratories are being mobilized and focused by these programs.

Work in the United States is sponsored in several of the constituent areas by the government. Individual programs are aligned with those firms in the private sector most closely related to the specific project. At NBS, for example, our work in advanced ceramics is

performed in collaboration with Centers for Materials Processing at the Massachusetts Institute of Technology, Rutgers University, and Ohio State as well as DOE and DOD contractors such as Cummins Engine and Garrett Turbine Engine Co. Our work in ceramic phase diagram data, which are roadmaps for composition design and process control, is planned and carried out jointly with industry through the American Ceramic Society.

Fiber Reinforced Composites and Polymer Blends

Lightweight, high strength fiber reinforced composites are being introduced in load bearing applications in aircraft such as the cargo bay stanchions made by Hercules for the Boeing 757. These stanchions weigh half as much as an aluminum stanchion and are almost twice as strong. The fraction of composites in passenger aircraft is expected to increase to about 65% in turn of the century subsonic designs. The space telescope relies on a graphite fiber composite optical bench which is strong, lightweight, and has very low thermal expansion over a wide temperature range.

Polymer blends, which are mixtures of two or more different polymers represent one of the most rapidly growing areas in the $240 billion synthetic polymer

industry. Blends already account for 20 percent of U.S. polymer production and use is projected to triple between 1982 and 1987.

Blending provides a straightforward and relatively inexpensive way to develop polymeric materials with improved performance. Because the polymeric raw material typically accounts for two-thirds of the manufacturing cost of a plastic part, industry looks to blends based upon relatively low cost polymers to provide new, tailored high performance materials.

A major challenge in this work is the characterization of the morphology and microstructure of polymer blends as a function of composition and processing. Many approaches are required, but one of the most powerful is the use of small angle neutron scattering. Firms such as Exxon are using the neutron scattering facilities at NBS to characterize new blends. However, the United States has fallen behind the countries of Western Europe in the development of the most advanced neutron research laboratories. France, Germany, and England together have invested over $100 M in totally new research and measurement facilities that produce high intensity "cold," or long wavelength neutron beams which

are essential for the science and development not only of polymer blends but for all classes of materials. The Japanese are including similar facilities in a major expansion of their research capability in this area. The United States does not have a comparable installation.

ADVANCED PROCESSING IN OUR BASIC INDUSTRIES

I have begun by pointing to the promise of high technology materials and products, and the central role played by advanced processing in their structures, properties, and performance in service. But important as these new technologies are to our future as a country, we must also look at the economy as a whole. High technology makes on the order of twenty percent of the manufacturing sector's contribution to our economy. The bulk of the remaining contribution is made by basic industry, which is responsible for over eighty percent of our employment in manufacturing. Advanced processing will be crucial to the continued health of this basic sector as well. I am referring here not only to automation, which is surely important, but also to applying the lever of sophisticated understanding of materials processing to our basic industries.

Steel Industry

In implementing its portion of the President's National Materials and Minerals Program Plan and Report to Congress of 5 April 1982, which responded to the National Materials and Minerals Policy, Research and Development Act of 1980, NBS works closely with the Department of Commerce Office of Strategic Resources headed by Mr. Robert Wilson. We, in cooperation with the Departments of the Interior and Defense, held a public workshop last October on "Trends in Critical Materials Requirements for Steel of the Future; Conservation and Substitution Technology for Chromium." It included 50 presentations by technical authorities from steel producing and using industries. The results emphasizing the role of processing and substitution will be summarized in a report to the Congress by Mr. Wilson's Office. Another workshop at NBS held in collaboration with the American Iron and Steel Institute and the Department of Defense addressed "Process Control Sensors for the Steel Industry." I have brought along copies of the report of this workshop.

These reviews were particularly timely because of the severe depression being felt in the sale of steel, caused by the current world-wide recession, and compounded

by increasingly strong competition from abroad. This competition is viewed as an unusually severe challenge because it is based on capital-intensive advanced processing technologies, which American companies now find difficult to finance. For the U.S. industry, the key to a strong competitive position is better performance, superior product quality, and reduced costs. These in turn will be achieved through technical developments in processing and in innovative materials. The nature and direction of the advances in these two technical areas will influence strongly the industry's future.

The large integrated mills, which make the bulk of steel sold in this country, can become far more efficient through sophisticated new processing technology, although very large sums for investment in equipment that incorporates this new technology will be required. The new mini mills, convert relatively low cost scrap from the immediate vicinity of the mill into products in high demand in the same small area. In doing so, they minimize transportation costs and have remained relatively profitable through the incorporation of modern technology in highly efficient and relatively low cost new facilities. The specialty steel sector has also remained relatively

competitive through the incorporation of sophisticated technology coming from its leadership on a worldwide basis.

There are vital common technical thrusts to what is happening in all three of these sectors. These thrusts include continuous casting; duplex melting; and clean steels, in which impurities are removed and replaced by relatively small amounts of alloying elements. For the steel industry to realize the full promise here, technical advances in processing science are needed. We need to understand in detail the special structural property relationships of the new "clean" steels, and how these structures and properties are influenced by processing. Then, armed with this knowledge, we must develop technologies to control processing in real time using sophisticated sensors and computerized feed-back systems.

The American Iron and Steel Institute (AISI) has identified the development of process control sensors as an area of research that would have substantial impact toward improving productivity and quality in the steel industry. In their analysis, 35 steel processes were studied and 537 process control sensor needs were

identified. Of these, AISI assigned top priority to four specific sensor needs, which are identified in the report that I have with me. AISI and NBS have initiated a joint program of research aimed at the development of two of these sensors-for temperature measurement and porosity detection. Both sensor systems couple advanced laser techniques for generating/detecting ultrasonics with computer assisted tomography to provide visual information for in-process monitoring and control purposes. To transfer this advanced technology effectively to industry, the steel industry will sponsor research associates from individual AISI member companies to participate in the research programs at NBS.

Welding

Recently the OSTP Committee on Materials has identified welding technology as a high priority area and has established a COMAT Task Group chaired by NBS. It is the objective of this Task Group to coordinate Federal welding research and, working with private sector groups, to establish R and D priorities for welding and to develop short range and long range implementation strategies to improve the U.S. position. Welding is a critical materials processing technology in manufacturing

and construction. Efficiently produced, reliable welds contribute to productivity and competitive positions in aircraft, electronics, and automobile production, and in the construction of ships, bridges, buildings, pressure vessels, pipelines, and offshore structures. The welding industry consists of many firms large and small including weld shops, apparatus makers, suppliers of consumables, and large manufacturers. Heretofore, welding R and D and technology implementation have not been effectively coordinated in the U.S. In foreign industrial countries national welding centers have been established to deal with the disaggregation inherent in this industry. This is the case in the U.K., Canada, Japan, Germany, Belgium, Denmark, Italy, and the U.S.S.R.

An 1983 NBS report, which was requested by the House Committee on Science and Technology, establishes the need for material processing control in welding. This report establishes the large costs of fracture and fracture prevention through overdesign in the U.S. economy· 4% of U.S. GNP or about $120 billion per year. Structural failures--fractures--commonly occur at welds and therefore a major research area to reduce weld failures is to minimize property variability in weldments through improvements in better material processing, i.e., welding.

The Welding Research Council (WRC) and the American Welding Society (AWS) realize the need for a coordinated U.S. effort in welding with respect to research and implementing research results in industry. These organizations and the American Society for Metals have joined with the COMAT Task Group and initiated a plan for an improved and coordinated national strategy in welding research and technology transfer.

On April 28, 1983, a Conference was held in Philadelphia, PA, sponsored by the above organizations to evaluate research opportunities and to develop a strategy for near-term and long-range enhancement of welding technology. At this Conference, a priority R&D list was established based on reviews of over 100 research, development, and engineering proposals by welding specialists from all sectors. Process control, sensor development for automated processing, and predictive control models for automating arc welding and electroslag welding, received the highest priority. Also a Committee representing COMAT, WRC, and the AWS was established to draft a national action plan within 90 days. The objectives are to coordinate industry, university, and government resources; to pursue the highest priority R&D areas in welding; to bring R&D

results into practice efficiently; and to advance the U.S. competitive position in welding technology.

COORDINATION

The Federal government's materials research effort is of the order of a billion dollars annually distributed among 15 or so mission agencies. It is obviously important to assure effective use of this resource in priority technical areas of national concern, and to ensure that the research is effectively meshed with the needs and the ongoing research activities of the U.S. private sector. In this testimony I have described two emerging national priority programs in rapid solidification processing and welding. In both areas the government-wide programs are being coordinated in cooperation with the university/industry communities.

The common and essential elements of this approach are: to identify a manageable technology area where research is needed and where there is clear recognition of need at the national level; to establish a firm communication link with those parts of the private sector with an interest in the technology; and to provide a workshop forum for a review of ongoing programs

and a mechanism for establishing authoritative consensus on priorities and implementation strategies.

Other specific materials R and D efforts within the government may be unique to the mission of a particular agency. I have given examples of such activities involving agreements between NBS and various industrial organizations including the American Society for Metals, the American Iron and Steel Institute, and the American Ceramics Society. Other such cooperative programs with industry in the Center for Materials Science at NBS include: agreements with The National Association of Corrosion Engineers, the Welding Research Council, the American Dental Association, and individual industries. A brief description of these activities is included as an attachment to this testimony.

Attachment to Testimony by Robert Mehrabian

COOPERATIVE PROGRAMS WITH INDUSTRY
IN THE CENTER FOR MATERIALS SCIENCE

- As part of the joint NBS/American Society for Metals (ASM) program, the ASM is developing funding support from industry ($4 million) and assisting in the dissemination of computerized alloy phase diagrams. This NBS/ASM activity is part of a comprehensive program that includes 33 data centers worldwide. A parallel effort for ceramic phase diagrams is described below. Planning for phase diagrams for polymer blends is underway.

- The American Ceramic Society is expanding its cooperative effort with NBS to computerize phase diagrams of interest to ceramists. In parallel with the ASM effort above, the American Ceramic Society will develop industry support and disseminate phase diagrams and related information.

- The American Iron and Steel Institute and NBS have recently agreed to be jointly responsible for a program to conduct research aimed at developing process control sensors for the steel industry. The joint program will concentrate on rapid, on-line measurement of temperature distributions and automatic detection of porosity in steel.

- The National Association of Corrosion Engineers and NBS are providing evaluated corrosion data on alloys and other materials based on a recent agreement. NBS will provide technical guidance and NACE will develop program and funding support from industry.

- The Welding Research Council and NBS will conduct joint research programs in welding and develop improved and more efficient weld procedure qualification methods.

- The American Dental Association, in a 53 year old cooperative program at NBS which is partly supported by the National Institute for Dental Research, has made many advances in dental materials. Current advances from cooperative research efforts of the

25 ADA supported research associates and NBS staff are dramatically improved adhesives for tooth restoratives and more effective fluoridation treatments based on understanding of tooth mineral phase diagrams.

The Joint Committee on Powder Diffraction Standards supports eight research associates at NBS to critically evaluate powder diffraction data and disseminate results for use in chemical identification. The joint committee provides funding support through sales of the Powder Diffraction File which is now being computerized and the closely related Crystal Diffraction Data computer file maintained at NBS.

Examples of other industrial interactions include support of research associates at NBS by Exxon to work on the use of small angle neutron scattering to characterize polymer blends; by General Electric to use a unique time domain polymers at NBS, and by Martin Marietta to characterize resins used on the space shuttle.

Robert Mehrabian

Robert Mehrabian has been Director of the Center for Materials Science, National Bureau of Standards since 1982. From 1979 to 1982 he was Chief of the Bureau's Metallurgy Division. Prior to that he was Professor of Metallurgy and Professor of Mechanical Engineering at the University of Illinois in Urbana, Illinois. Dr. Mehrabian received his Bachelor of Science and Doctorate of Science degrees from the Massachusetts Institute of Technology, where he remained to hold successively positions as Research Associate, Assistant Professor, and Associate Professor, before leaving to join the University of Illinois.

Dr. Mehrabian has published approximately 90 papers and edited 5 books in the field of metallurgy, and has been awarded 7 patents in new metal forming and composite fabrication processes. He has been a consultant to numerous industries and has served on advisory committees of the Department of Defense and the National Research Council of the National Academies of Science and Engineering, where he has recently chaired the Committee on Rapid Solidification Processing. Dr. Mehrabian has established a number of coordinated

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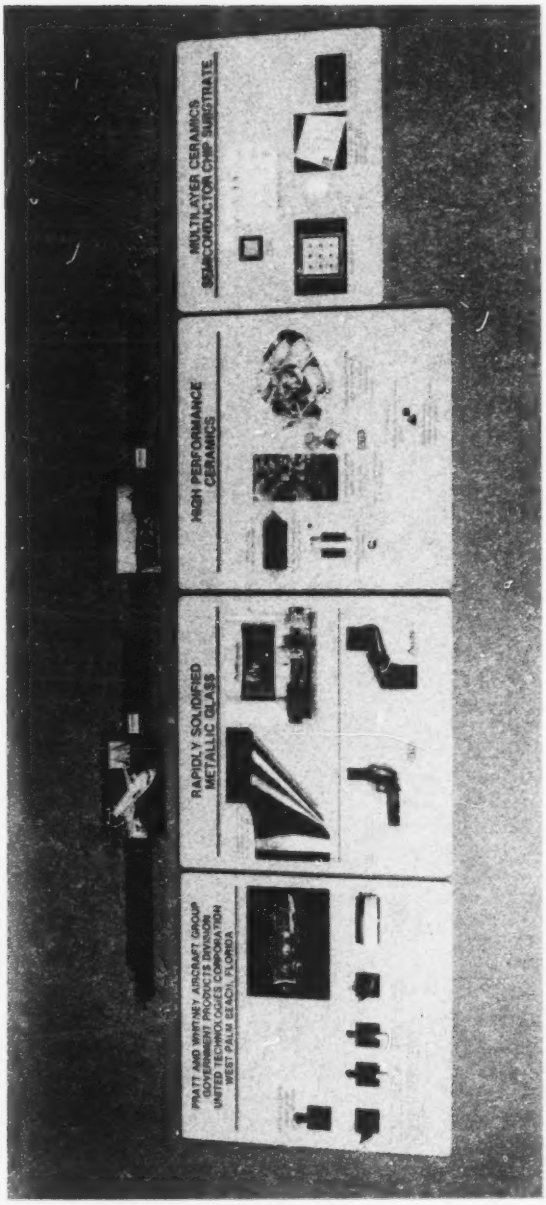
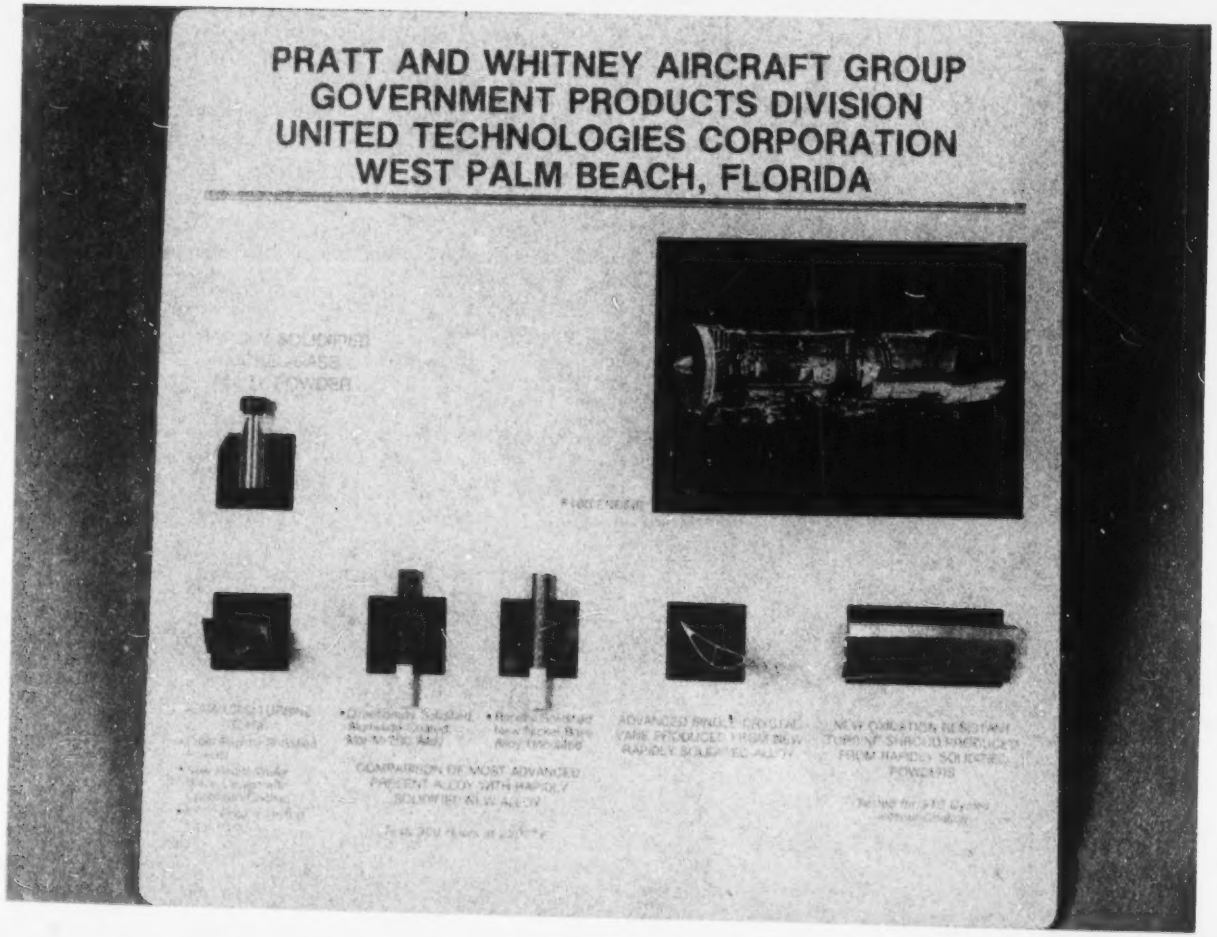
university/industry/ government programs at NBS including the phase diagram program with the American Society for Metals. Dr. Mehrabian has also been an active member of the Committee on Materials (COMAT) of the Office of Science and Technology Policy. For COMAT, he has played a strong role in the coordination of federal programs in rapid solidification and is now serving as chairman of the COMAT Task Group on Welding Technology.


PRATT AND WHITNEY AIRCRAFT GROUP
GOVERNMENT PRODUCTS DIVISION
UNITED TECHNOLOGIES CORPORATION
WEST PALM BEACH, FLORIDA
RAPIDLY SOLIDIFIED
METALLIC GLASS
HIGH PERFORMANCE
CERAMICS
MULTILAYER CERAMICS
SEMICONDUCTOR CHIP SUBSTRATE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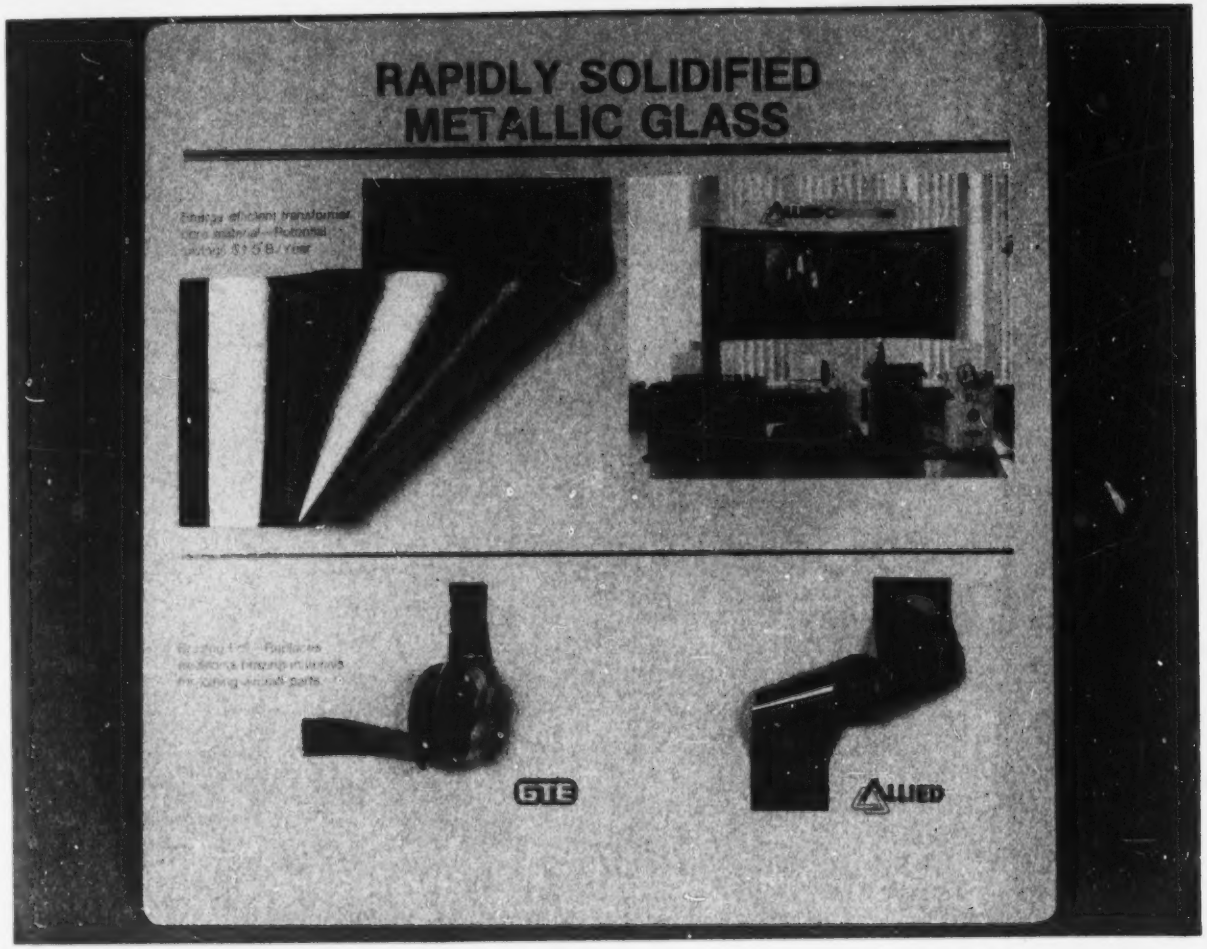
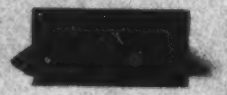

RAPIDLY SOLIDIFIED
METALLIC GLASS
GTE
ALLIED

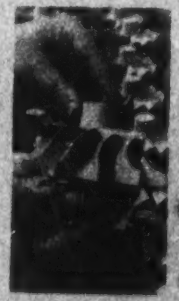
HIGH PERFORMANCE CERAMICS

TRUCK DIESEL
ENGINE COMPONENTS



Partially Stabilized Zirconia
Coated Cylinder Section

Partially Stabilized Zirconia
Valve Guide

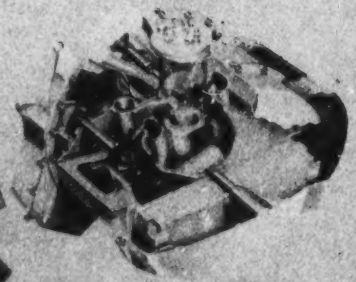


AUTOMOBILE TURBINE
ENGINE BLADES

Silicon Nitride
(Si_3N_4)

Potential 30-40% Increase in Fuel Efficiency

GTE



ADVANCED GAS TURBINE
FOR AUTOMOBILES

General Motors
Carborundum
Corning
GTE

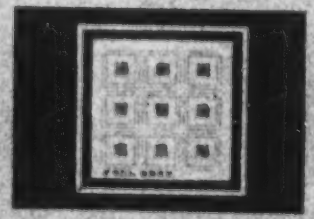
CUTTING TOOLS

Silicon Nitride—Titanium Carbide
(Si_3N_4) (TiC)

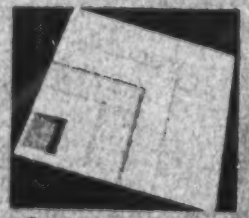
Greater Productivity
- Higher Metal Removal Rates
- Lower Tool Wear

MULTILAYER CERAMICS SEMICONDUCTOR CHIP SUBSTRATE

Multilayer Multichip Module

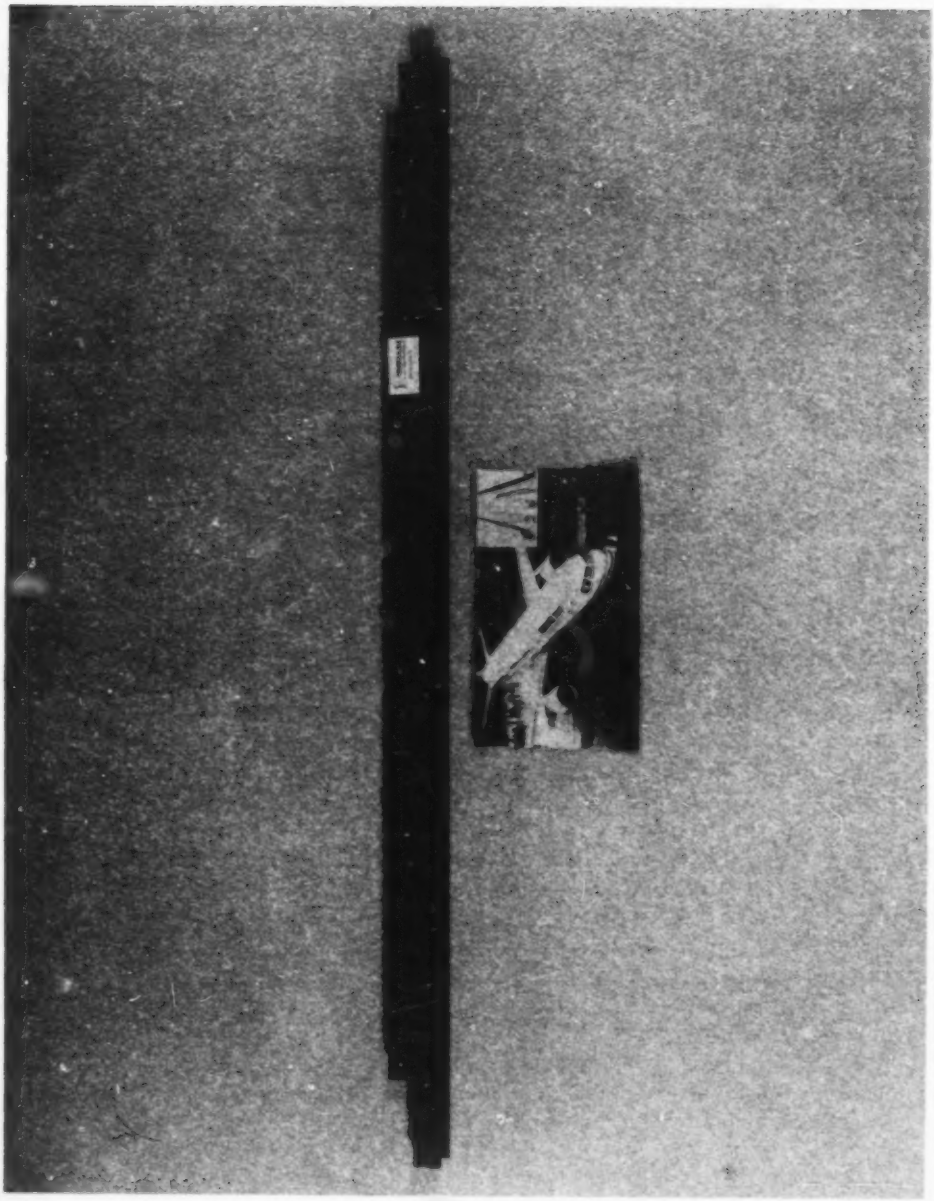


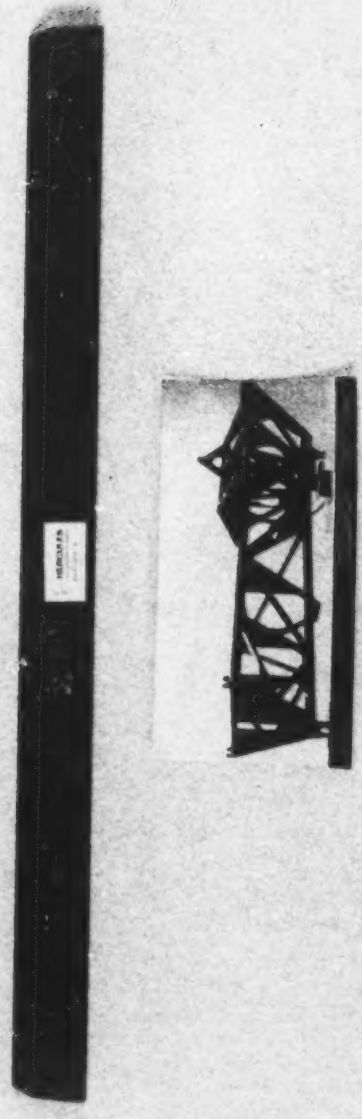
Multichip Substrate



Cross section of the laminate showing screened patterns on substrate sheet

Fragments of Alumina Layers before firing





Mr. GLICKMAN. Thank you, Dr. Mehrabian.

Now, we are pleased to hear from Dr. Roy. That is a name that means something to me. I used to have a colleague in Congress named Dr. Roy. He was a medical doctor and in for two terms. It is a pleasure to have you here.

Dr. ROY. Thank you very much, Mr. Chairman. It is always a pleasure to come and provide some kind of insight that any of us as citizens can bring to legislators. I will put on two hats today, Mr. Chairman:

First, I will be a scientist in my own field of materials science, ceramics especially. But second, I will be a policy analyst, since I have been spending time at the Brookings Institution this last year, and for many years, I served, as Congressman Ritter pointed out, on the State's Materials Advisory Panel, trying to make policy at the State level.

So, if you will permit me, I will move not only from a scientific base, but toward the policy issues.

Let me start with the question of the focus of the relationship of materials policy to jobs. It is my considered opinion that the United States will soon face a jobs famine and that we are heading toward a major crisis if we do not restore what Congressman Ritter referred to, what I call our "midday" industries; it is complete nonsense to talk about high-tech alone and sunrise and sunset industries.

So, I was very pleased that Congressman Ritter pointed that out, because I think that not only does preoccupation with high-tech meet a jobs famine in all the other industries, but going beyond that, this requires us to relate our on-the-shelf technology to industry. Prof. Dereck DeSolla Price, the historian at Yale, has studied the relationship of science to technology and finds that the model the United States bases its science policy on to be completely wrong. Therefore, I want to start with that first issue: What is the relationship of science to technology? I believe, for 30 years, we in the academic community have really misled the Nation with the wrong theory.

We used to think that if you planted an apple tree, called science, and you watered it with dollars, out would come the apples of technology. That is wrong. Science and technology are independent trees, and the Japanese have shown us that they can make—as shown in my little sketch—good technological apples without any science. The science tree only attracts bees to cross pollinate the technology one.

The tree of technology is fed by investment, it is fed by applied science, by public support, by banking, all those things. Very different from science. We in America do science very well, Mr. Chairman. The problem is we never put it to work. So, our science-utilization system is extremely poor. I suggest that that is where we should be really looking for improvement.

Now, I use as a case study the recent decisions on the LBL-NCAM as making a decision in the materials policy.

Mr. GLICKMAN. What was that?

Dr. ROY. The Lawrence Berkeley Lab's NCAM decision proposed by OSTP. Now, I completely support the concept of reprograming the national labs, but if we confuse that with materials policy, then

I think we stand in two dangers: One, is that we really mistake science for technology, and the other is we think we have done something in materials policy. And I know that the LBL–NCAM has very much to do with materials policy.

One of the biases operating in this decision is the bias toward high science, concentrated in one place. I believe that today, the game has got to be in networking of the Nation's capabilities where they exist. We cannot concentrate capabilities in one place. That is the bias of high energy physics, it is not the way the materials industry works. It is not the way science works in other disciplines.

So, what would I propose first is to strengthen U.S. materials policy.

Let me start with, again, what Don Ritter said. We have got to get away from the idea that media hype on high-tech is going to solve our problems. We have got to apply science and technology to all the levels of industry. Even within the materials industry, we have what Dr. Boretsky of the Commerce Department calls a range of technology intensivity. I want to show you some figures that Boretsky has developed, if I may.

Let me just make two points from Boretsky's data which address the question: Are we going to revive American industry on the basis of high-tech industries alone? I am going to show you that Boretsky's data is not going to give us much encouragement on that.

The table 1 shows that the rest of the world is catching up to us on productivity. That is if the gross domestic product per employed person in the United States is 100, you notice that Germany has moved up to 93 in 1980, and Japan to 69, and the average foreign country is already 78. So, the world is rapidly catching up.

The next part of the table shows you why it is so dangerous to address this situation by supporting high-tech alone. Look at the world market share in high-tech products, technology-intensive products, and in overall industry. You will see that in technology-intensive products, we are slipping faster than we are in overall industry.

Now look down at the trade balances, if you will. The only place where there is a black column, is in the low-tech column; in the 1970 to 1980 ratios, we are still OK only in low-tech. Look at the high-tech ratio. We have slipped by a factor of 2.5.

So, if you think the U.S. economy is going to recover via high-tech alone, I believe you will be building on sand. We must improve the use of technology in all areas. All this is from the Department of Commerce's figures, these are not my data.

So, what kind of policies can we institute to meet the real challenge? I think we can now move to three key responses. One is, we have got to learn to cooperate instead of compete in R&D. We have got to learn to put together teams—Dr. Flemings talked about that in his last slide, also, his last recommendation. We have to learn to interact between industry, government, and universities.

Now, I am going to give you a model of how we interact, by choosing the Japanese ceramics story. Penn State is the Nation's leading ceramics lab, with due deference to my colleagues on the left, we are twice the size of anybody else in modern ceramics research.

Mr. GLICKMAN. Is that universally agreed to and accepted without qualification?

Dr. ROY. I think in ceramics, that is true; not in all materials.

Mr. GLICKMAN. OK.

Dr. ROY. I should start with a quotation from the National Science Board hardly 5 years ago. This august body in deciding what materials research should be supported by NSF said: Ceramics is not an important field in materials science; that is something for industry to do. In other words in the judgment of NSF ceramic materials were not worthy of a university's attention. So you see that we owe the Japanese a great debt, because the Japanese have made ceramics respectable. And the very same persons who relegated it to industry are now no doubt writing proposals to the same agency. That will tell you the state of ceramics in the United States. Now let us turn to see how the Japanese went about it.

On the basis of a scientific analysis of trends in materials availability and new science the Japanese consciously selected ceramics as a major field. Let me show you what the ceramics market is and what media hype does to distort it. Fig. 1 is from a report on the Japanese ceramics effort, not the media's version of it. Notice that the word ceramic engine does not appear. Notice that they focus on the electronics ceramics market, a $500 million industry in the United States, which is going to disappear very shortly.

Look at the machinery market, within which is one item, which is the ceramic engine. Now, the U.S. total policy has been focused on that damn fool ceramic turbine, as though that is the only ceramic industry there is.

In the meantime, we are losing all the other industries. That is the kind of distortion which appears in our national science policymaking which is run by media hype.

The next Fig. 2 will show you how the Japanese went about it.

Notice the time schedule, Mr. Chairman. It took them 2 years of talk, of organization, of getting the cooperation going. In October 1980, they announced the program then they spent a year getting feedback from materials industrialists and academicians. That is what was not done in our LBL-NCAM decision. Who was making that decision? Certainly no one in the materials research community. How can you implement a policy when the whole community opposes it?

In the Japanese case, every industry was involved. Every university was involved in making suggestions, they defined the final program, it was both bottoms-up and top-down.

One year later, they announced the content of their program. They didn't announce the program and then say, "Do it." They spent a year getting ideas together. In the same year, the industry announced the formation of its associations, and by July 1982, they were rolling.

Now, that is the kind of process I believe that we must also adopt in policymaking—what the Germans call "mitbestimmung." We cannot go on any more saying, these guys are good scientists, give them some money, and stick the label materials on it. We have got to get cooperative about it.

Now, the next one please.

Mr. GLICKMAN. Are those slides in your testimony?

Dr. ROY. No; these were extras, Mr. Chairman, I just threw these in.

Mr. GLICKMAN. Can we have those?

Dr. ROY. Of course, you may.

Mr. GLICKMAN. I would like them to be included in the final report because I think they are extraordinarily useful.

Dr. ROY. Sure. I am sorry I didn't include them there.

[The information follows:]

Fig. 1

THE SCOPE OF NEW CERAMICS IN JAPAN

	PRODUCT	MARKET SIZE (in billions of yen)
For Electronics industry	IC package, insulation subtrate	117
	Ceramic capacitor	72
	PZT ceramics	65
	Thermistor and varistor	27
	Gas and humidity sensor	1
	Ferrite	85
	Translucent ceramics	4
	Heat generator	2
For Industrial machinery	Cutting Tool	12
	Wear-resistant materials	7
	Heat-resistnat materials	9
	Catalyst carrier for emission control	8
Other uses	Artificial bone	-
	Nuclear fuel and material for atomic power generation	1
TOTAL		410

Fig. 2.

THE SCHEDULE OF "MITI" INTERVENTION IN CERAMICS

OCT. 1980	MITI FORMS "FINE CERAMICS TECHNOLOGY RESEARCH ASSOCIATION.
OCT. 1981	MITI LAUNCHES 10-YEAR PROGRAM FOR BASIC TECHNOLOGY DEVELOPMENT INCLUDING CERAMICS.
OCT. 1981	INDUSTRY ESTABLISHES 3 TRADE ASSOCIATIONS. • FINE CER. TECH. RES. ASSOC. (15 companies incl. Toshiba, Kyoceva, NGK etc). • ASSOCIATION FOR NEW FUNCTIONAL ELEMENTS (10 Companies). • ASSOCIATION FOR NEW METALLIC & COMPOUND MATERIALS (16 Companies).
JULY 1982	MITI ESTABLISHES "FINE CERAMICS ASSOCIATION" (FCA) BECAUSE "new ceramics will replace metals in the coming generation"
OCT. 1982	170 COMPANIES JOIN FCA.

FIG. 3.

PERSONNEL BASE FOR CERAMICS RESEARCH

A. NUMBER OF RESEARCHERS BY LINE OF BUSINESS IN JAPAN*

	RESEARCHERS (PERSONS)				
	YEAR				
	1977	1978	1979	1980	1981
ALL INDUSTRIES	151 437	153 706	157 279	173 244	184 889
CHEMICAL	28 259	29 228	29 506	31 556	32 847
CERAMICS	4 004	3 894	3 652	5 355	4 799*
IRON AND STEEL	4 124	4 176	4 305	4 434	4 800
NONFERROUS METAL	2 130	2 186	2 403	2 385	2 895
MACHINERY	13 426	14 375	12 642	15 273	15 390
PRECISION MACHINERY	4 590	4 935	5 685	6 188	7 061

* The ratio of ceramics to metals is much higher in Japan than in the U.S.

B. NUMBER OF STUDENTS ENROLLED IN VARIOUS FIELDS IN MATERIALS SCIENCE AT JAPANESE UNIVERSITIES

FIELDS	NUMBER OF UNIVERSITIES	NUMBER OF DEPARTMENTS	NUMBER OF STUDENTS PER YEAR
METALLURGY	25	33	1,629
APPLIED CHEMISTRY	78	109	8,414*
TEXTILES	9	16	685
CHEMISTRY	42	46	2,184
INORGANIC MATERIALS	3	3	122*
TOTALS	157	207	13,034

* These are both sources of ceramics personnel.

25-958 O—83——17

Table 1

TRENDS IN U. S. COMPETITIVENESS IN "HIGH-TECH"

DATA FROM - M. BORETSKY - DEPT. OF COMMERCE

DEFINITIONS: "TECH. INTENSIVE: = 5% VALUE ADDED SPENT ON R&D
(12% of all Mfs.) 5% WORK FORCE CONSISTS OF SCI./ENGRS.

"HIGH TECH" = 10% OF SAME PARAMETERS
(6¢ of all Mfs.)

TREND 1. RELATIVE TO U. S.: GDP/employed person in Japan, Germany have reached new highs.

	1880	'50	'60	'70	1980
U.S.	100	100	100	100	100
AVERAGE FOREIGN	67	37	47	63	78
JAPAN	35	17	26	51	69
GERMANY	68	39	58	73	93

TREND 2. U.S. WORLD MARKET SHARE IS SLIPPING FASTER IN TECH-INTENSIVE PRODUCTS THAN TOTALS.

	OVERALL		TECH-INTEN. PRODUCTS	
	1937-50	1980	1937-50	1980
U. S.	27.3	16.4	35.5	20
JAPAN	3.4	11.0	1.8	15
GERMANY	7.3	10		
U. K.	25	10	19	9

TREND 3. TRADE BALANCES FAVOR U.S.. IN LOW-TECH AREAS

	1970			1980			RATIO '80/70		
	HIGHT	T. INT.	LOW T.	HIGHT	T. INT.	LOW T.	HIGHT	T. INT.	LOW T.
U. S.		10	28.8		42	24.4	4	4.2	.85
JAPAN		7	11.6		70	15.6	9	10	1.4
GERMANY		13	10.4		65	11.2	6(France)	5	1.1

Dr. ROY. Now, this is the second thing the Japanese do, they get their technical personnel trained. Let me show you the numbers of the scientists and engineers necessary for ceramic industry: they are so staggering it scares me. In the two parts of Fig. 3 I show that in servicing their ceramic industry I am only referring exclusively to ceramics—many of their people come out of applied chemistry. You will see a number of 8,000 students per year, Mr. Chairman? Let me tell you that in the United States, you couldn't rub 10 professors of chemistry together in the whole country that do inorganic work. It is too low technology for chemistry departments to be involved in. The education here is done by ceramics departments. They produce, maybe, 500 students a year. The Soviet Union produces even more applied and inorganic chemists than the Japanese. Their academy institute for inorganic chemistry has 3,000 scientists. Now, we have to ask the question, who is going to do the job of running the ceramic industries in the United States? What kind of training capabilities do we have?

To meet the challenge in ceramic materials, we must prepare both people and a cooperative institutional base if we are going to get anywhere.

I believe that for this kind of planning and process, we must look to the Congress. I don't believe the executive has made any discontinuous proposals: if business as usual has got us in this pickle, how can more of the same help? I believe that only the Congress can do it, it cannot be started in the executive because we in the universities have our client relationship—to the agencies, and we scratch each other's backs—and that is not going to help.

Mr. RITTER. If I might interrupt? I am glad that Dr. Roy feels that we in the Congress are free of client relations.

Dr. ROY. No; you have a more dispersed set, maybe a different set. That is the only hope, Don.

Mr. RITTER. Larger.

Dr. ROY. Larger, true.

Well, what am I proposing? I am supporting recommendations which have both been produced by congressional—I mean Presidential Commissions.

First, to force interaction is very simple. This Congress could legislate tomorrow that NSF and DOE-OBES should put some, say 25 percent of its materials research money into cooperative ventures. That was recommended by the Baruch Commission. President Carter's Commission on Innovations. In effect the "Who is the best peer review?"

The best peer review is industry in search of talent. If they gave MIT $50,000, they have looked over those guys, and have said, "There is some research competence there that we want to buy." The Commission's simple process says that the NSF or DOE-OBES should support them with matching funds. That is in Mr. Carter's innovation study. It is, in my view, the most efficient and effective way of getting enhanced cooperation between universities and industry. Yet quite naturally the bureaucracy opposes it. But Congress can easily mandate it.

Mr. GLICKMAN. What did you say the NSF and the——

Dr. ROY. Office of Basic Energy Sciences of the Department of Energy.

Mr. GLICKMAN. Thank you.

Dr. ROY. Last year, the university communities also opposed the set-asides for small business. I happen to believe that small business is where a great deal of the innovation is, hence, I recommended that Congress double the set-aside, but require that half that money given to the small business to be spent by them on their choice at some university. This simple policy would build bridges, hundreds of them between universities and small industries.

It will force them to look toward universities, but only they will review the universities, to find where to spend their money. So I think that by simple new actions, we can get individual cooperation going all over the Nation. But it will take action on the part of Congress to start it.

The last thing I suggest is precisely what Professor Flemings suggested also, that we really must make new teams, and I propose the creation of applied materials research centers. Many of the existing materials science centers have become captured by the physics community, and their character cannot be changed.

What is called materials science varies greatly—a rose is not a rose is not a rose—hence, if you want applied materials research connected to industry, I believe one must create new centers of a new type. We have them at the Bureau of Standards. They have for example the building research centers; and the center for fire research and new ones in glassy metals. They are doing the kind of work we so badly need.

We have just set up such a center for dielectrics and the capacitor industry at Penn State. It is funded by DOD and partly by NSF, and some 20 industries. If there is no hard money industry participation, I don't believe the coupling can possibly be fruitful in the long run.

So, I believe that establishment of a cooperative base of research bringing together universities, Government labs, and industry, can be done, and it can be done, Mr. Chairman, by congressional action.

Thank you.

[The prepared statement of Dr. Roy follows:]

Testimony of Professor Rustum Roy

Witness Qualification

Mr. Chairman, it is a privilege to share what insights a citizen has with the legislators of his nation.

My remarks on National Materials Policy, including the specific act under review, will be made from the viewpoint of one who has served actively in an advisory role in the National Academy through its National Materials Advisory Board and its COSMAT study, as chairman for 15 years of the State of Pennsylvania's Materials Advisory Panel of the Governor's Science Advisory Committee, as continuous consultant to industry for 30 years, and as Director of one of the nation's oldest and largest Materials Research Laboratories, in the University which the National Science Board shows has the highest percentage of research support from industry among the top 25.

My remarks will be tempered by the fact that I am chairman of my University's Science, Technology and Society program, teach the Science Policy course and am spending the year as Science and Public Policy Fellow at the Brookings Institution and have just completed a book on the failures of U. S. Science Policy coauthored by Deborah Shapley.

Mr. Chairman, your hearings are concerned with two aspects: Oversight of P.L. 96-479 and a broader survey of how Government policy with respect to materials research and development can be strengthened. I believe that the latter hold the key to the former and will therefore focus my remarks on matter of U.S. materials research policy in general.

I start my remarks by giving you the bad news that in my opinion the technological posture of the U.S. industry that in the area of materials is deteriorating very fast and that there is no conceivable hope that business as usual with minor budget or policy additions will help. Moreover, I believe that the basis of the present Administration's hope for improvement is fundamentally in error--providing more money for basic science cannot and will not by itself help the materials industry now or later. Unless other much more important policy actions are taken this will produce some more papers to lengthen the bibliography of professors like myself and help Japanese and German industry.

The bad news is plentiful and serious and difficult to overstate - it is so bad. The good news is, that contrary to most of my academic colleagues, I will show that none of the most important changes needed call for a single additional dollar. Indeed more money for present objectives will hurt the nation's economic and technological health.

I begin with an analysis of our mistakes because to those who say we need no changes I say simply how could we have gotten here if starting with the enormous positive advantages we had over the rest of the world hardly 30 years ago. Table I lists what's wrong, in my view with our policy.

TABLE I

WHAT'S WRONG WITH U.S. POLICY

- IT HAS USED A FUNDAMENTALLY INCORRECT THEORY, OR MODEL OR PARADIGM ON S-T RELATION.
- GROSSLY UNDERVALUED APPLIED AND INDUSTRIAL RESEARCH.
- GROSSLY NEGLECTED SCIENCE EDUCATION AND PEOPLE FACTOR: GENERAL PUBLIC; TECHNICIANS ETC. CONCENTRATED ON "SUPERSCIENTISTS" (AND HAD NO IMPACT).
- NO LINKS BUILT BETWEEN BASIC SCIENCE AND USEFUL TECHNOLOGY. HENCE OUR BASIC SCIENCE IS USED BY REST OF THE WORLD. i.e., U.S. HAS MOST INEFFICIENT SCIENCE-UTILIZATION SYSTEM.
- U.S. MANAGED WITHOUT ANY TECHNOLOGY POLICY BECAUSE WE WERE SO FAR AHEAD OF WORLD. THAT DAY IS PAST.
- SCIENCE POLICY HAS BEEN CAPTURED BY ACADEMIC COMMUNITY AND THEIR AGENCY MANAGERS IN SYMBIOTIC RELATION WHICH OFTEN USES NATIONALLY VALUABLE GOALS TO PROMOTE AND FUND LEAST SALEABLE ESOTERIC SCIENCE.

The fundamental fallacy about which we have written a book is that since the war a grateful nation equated science policy with technology policy and turned it over to the academic science community do by a part of the physics community. The theory on which this was based is shown schematically in my second figure. The idea was that technological fruit grew on science trees. We sold that bill of goods year after year to the Congress: in our book, Lost at the Frontier, Shapley and I provide a series of quotes to show how deeply we believed this.

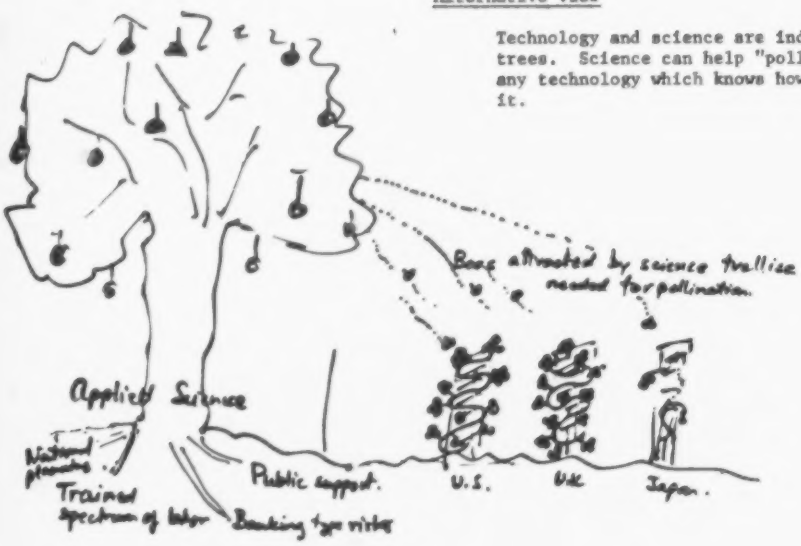
Scientists view of Relation of Science to Technology

Water tree of science with $, fruits of technology will appear.

Disproved by history.

Alternative view

Technology and science are independent trees. Science can help "pollinate" any technology which knows how to use it.



The historians of science never believed this: they reminded us that science of thermodynamics owed more to the technology of the steam engine than vice versa. The tree of technology has a life of its own and its relation to science is mainly as a source of cross-fertilization to produce new varities. The comparative history of Japanese science/technology with British science/technology have dealt a death blow to this theory. That is why we are here. If you want science to work for you you must design an active technology system to link into it, utilize it, put it to work. Without the linkages the science has no specific value to the nation. Please note I did not say it has no value. One would have thought that by 1983 the demise of the theory that sending money for basic science, (rubbing Aladdin's lamp?) will help U.S. technology, would have been stone cold dead. Yet the 1984 budget shows it is alive and well. $200 million more for NSF and cutting out $10 million for NBS Fire and Building Centers. That is really throwing money not at problems but into the waters! A derivative of their mistaken theory is the materials policy example, the LBL-NCAM proposal. In Table II I list what is wrong with the proposal from a materials policy viewpoint. But we need not dwell on our failures there are real opportunities for re-building an technology base but they will demand sharp discontinuous changes by the Congress.

TABLE II

CASE STUDY OF WRONG DECISION
MAKING, IN MATERIALS RESEARCH
"LBL-NCAM"

(1) DECISIONS MADE BY PHYSICISTS MASQUERADING AS MATERIALS RESEARCHERS (THE DOMINATION OF "BIG SCIENCE" PHYSICISTS IN U.S. POLICY MAKING IS A SERIOUS HUMAN PROBLEM IMPACTING POLICY)

(2) NO NEEDS ASSESSMENT CARRIED OUT BY MATERIALS INDUSTRY AND UNIVERSITY AND IN ITERATIVE CONSENSUS BUILDING PROCESS.

(3) NO COMPARISONS BETWEEN ALTERNATIVE POLICY OPTIONS.

(4) $250 M IS OUTLANDISH CONCENTRATION OF RESOURCES UNMATCHED TO MATERIALS INDUSTRY; CAUSED BY HIGH ENERGY PHYSICS BIAS TO "BIG SCIENCE".

(5) WRONG BASE. NOT NETWORKING OF MULTIPLE U.S. STRENGTHS. NO EXPERTISE IN MAKING ADVANCED MATERIALS. NO INDUSTRIAL DOLLAR COMMITMENTS.

Materials are "Mid-day" Industries:

Let me begin with some very general actions which I believe the national leadership can take relevant to materials policy considerations. I have summarized them in tabular form below. One can see that I believe that the current fixation on "high-tech" is technological and policy nonsense. The materials industries are neither sunrise nor sunset industries. I call them midday industries--essential to the basics of life shelter, food, transportation etc. A continental nation of 250 million that believes that it can plan to live on imported steel, aluminum, refractories, bricks, cement is living in a technological cuckoo land. The "highest tech" industries are the most volatile; they can be here today and moved to Mexico or Singapore tomorrow. The U.S. must have a reasonable mix of all levels of technology-intensivity (measured as by M. Boretsky by % of the workforce with technical degrees), adapted for all kinds of communities. The materials industries are well suited to this as GTE and Corning have demonstrated for decades with small plants in small communities.

TABLE III

GENERAL ACTIONS

TO STRENGTHEN U.S. MATERIALS INDUSTRY

(OUR BIG CORPORATIONS, BELL LABS, IBM, GE, ETC. ARE EXCELLENT MODELS OF GOOD R/D AND DO NOT NEED HELP, BUT THEIR NEEDS CANNOT DETERMINE OUR NATIONAL POSTURE; MIDDLE AND SMALL BUSINESS PROVIDES MOST OF THE EMPLOYMENT, AND INNOVATION).

- DAMPEN MEDIA-HYPE ON "HIGH-TECH" EMPHASIS, "COMPUTER-LITERACY", "ROBOTICS" ETC.;

  U.S. JOBS AND ECONOMY WILL NOT (INDEED CANNOT) BE SUSTAINED ON "HIGH-TECH". IT DISTRACTS NATION FROM GOOD POLICY MAKING.

- SUBSTITUTE "GOOD-TECH" (FOR "HIGH-TECH"), (EFFICIENT USE OF PEOPLE AND MACHINES TO ATTAIN PERSONAL AND SOCIETAL GOALS).

  MATERIALS COVERS A WIDE SPECTRUM OF TECHNOLOGY-INTENSIVITY: OUR GOAL IS TO MAKE ALL OF IT BETTER: FROM CEMENT MIXING FOR HYATT HOTELS AND HIGHWAYS TO LASER MELTED EPITAXIAL SILICON.

- MIX PROGRAMS FOR INDIVIDUAL AND CENTER-TYPE OPERATIONS ALL AIMED AT ACTUAL JOINT UNIVERSITY-INDUSTRY R&D PROGRAMS.

But the smaller materials industries are in trouble in a free-trade environment. They will be picked off one by one and we will lose jobs much faster than any possible replacement can be conceived of. A "jobs-famine" looms within a decade if no corrective action is taken. (I will not address the issue of free trade here but note in passing that I believe that the U.S. may well have to radically re-think its position on free world trade--and move to a nation-centered economy for a period in order to avoid serious dislocations.)

If we are not to lose existing materials industry radically new styles of R&D and investment must be found. To-day the U.S. Government spends 8 billion dollars in basic research and almost nothing to see that is fruits are effectively utilized. We don't need money, we need re-organization. Using the materials field I will describe alternative national policies which build tight coupling between our tax-payer financed R&D and the private sector industries.

If we are to save these industries we must turn around a 30 year tradition of independence of the University Sector, from its industrial connections. (I recognize that industrial attitudes and practices must change to match the university moves. My analysis supports in detail what Robert Reich has outlined in "The Next American Frontier". The bottom line Harvard business school theories have been even more devastating to American materials technology than the hubris of the scientists). But our present concern is with R&D alone, and here ALL NEW MATERIALS POLICIES MUST BE AIMED AT CAPTURING NEW KNOWLEDGE, SOME OF IT GENERATED LOCALLY, FOR IMPROVING U.S. INDUSTRY.

PROPOSED MATERIALS POLICY CHANGES

I have studied the ceramic industries, I know the science which feeds them in part, and the technological decisions companies face. I propose a mixed strategy using two schemes to bring about synergistic linking of the two systems, one on a totally dispersed basis for individual scientists and companies, and the other for national centers serving an entire industry (see Table IV). Notice I nowhere ask for any additional money, nor do I subtract any money from the university community.

I merely re-program existing budgets by using the good old fashioned American instrumentality of incentive. President Carter's Innovation study recommended the use of matching funds to stimulate University-Industry coupling. This Committee could direct NSF and DOE-OBES to experiment with this mechanism for any fraction of its Materials Research support. Materials would be an excellent guinea pig area. The most effective, most honest, most detailed peer review is made when a company looks over a University lab, and plunks down $50,000 to support some research there. Providing that University with $A x 50,000 to do any new research (not to add to the Company's money) is by far the best way to guarantee University-Industry pairing up.

RELEVANT (APPLIED) MATERIALS RESEARCH

TABLE IV

NEW GOALS	TO PROVIDE MAXIMUM INCENTIVE FOR ORIENTING UNIVERSITY RESEARCH TOWARDS INDUSTRIAL INNOVATION AND DEVELOPING PERMANENT UNIV-INDUSTRY LINKS.—"THE LAND GRANT MODEL"-- PROBABLY DOES NOT APPLY TO ALL UNIVERSITIES LOCAL-REGIONAL-NATIONAL FOCUS.
OLD GOAL	PRODUCE BASIC RESEARCH PAPERS. NATIONAL-INTERNATIONAL FOCUS.

USE MIXED STRATEGY

SET UP BOTH INDUSTRY-WIDE CENTERS

AND

ENCOURAGE DISPERSED EFFORTS

Along the same line, I believe precisely the opposite of my University colleagues who last year so volubly opposed the small-business set-aside. I would double it, and require the business to spend it within a University.

TWO NEW MECHANISMS

- USE BARUCH COMMISSION "INDUSTRIAL INNOVATION" RECOMMENDATION:
  FOR EVERY $ OF RESEARCH SUPPORT PROVIDED BY INDUSTRY,
  FEDERAL GOVERNMENT WILL PROVIDE X $ TO DEPT. OR UNIV LAB.
  (WHERE X COULD BE AS LOW AS 1 OR AS HIGH AS 7)
- DOUBLE SMALL BUSINESS SETASIDE, BUT REQUIRE THAT THE ADDITIONAL MONEY BE SPENT BY INDUSTRY AT UNIVERSITIES.

We turn now to the plan to create applied materials research centers. (see Table V) The Table is self explanatory as is the model in Table VI. At Penn State we have put into operation the National Dielectric Center on this model. DOD and NSF support it, along with nearly 20 companies. We have brought in three or four other Universities with special skills, and the whole program is an American response to MITI's prime target in ceramics - NOT the ceramic engine of the future alone, but the existing $500M electro-ceramics industry.

APPLIED MATERIALS RESEARCH

INDUSTRY - UNIVERSITY CENTERS

TABLE V

(1) BASED ON NATIONAL NEEDS ASSESSMENT BOTTOM-UP AND TOP-DOWN ITERATION.

(2) BASE ON EXISTING STRENGTHS AND DEMONSTRATED COMPETENCE OF LEAD ACTORS BOTH UNIVERSITY AND INDUSTRIES.

(3) ABSOLUTE PROHIBITION ON PROPOSALS; AGENCY MANAGER MUST TAKE RESPONSIBILITY FOR REASONABLE CONSENSUAL SELECTION.

(4) STRENGTHEN BASIC-APPLIED ENGINEERING LINKAGES AT EVERY STAGE. BETWEEN GOVT., INDUSTRY, UNIVERSITY R&D.

(5) ROLE OF GOVT. LABS. EXCEPT NBS, VERY COMPLEX. NBS MODEL IN CEMENT, FIRE, DENTAL RESEARCH CAN BE EASILY ADAPTED.

EACH CENTER PROVIDES

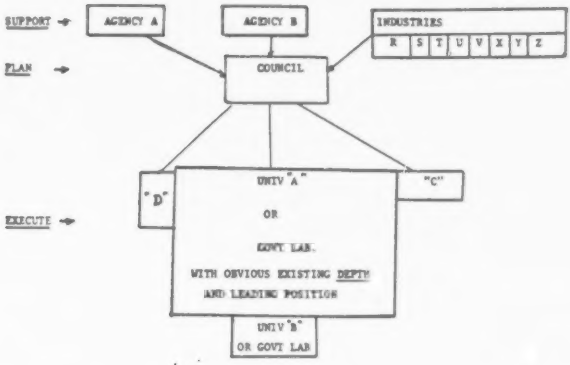
(1) CENTRAL U.S. ACCESS POINT FOR STATE OF THE ART KNOWLEDGE.

(2) COLLECTION OF INTERNATIONAL KNOW-HOW BY SYSTEMATIC VISITS BY UNIV. FACULTY.

(3) CENTRAL RELEVANT BASIC RESEARCH FOR ENTIRE INDUSTRY. AND TRAINING GROUND FOR PERSONNEL ON RELEVANT RESEARCH.

(4) PLATFORM FOR APPLIED AND DEVICE RESEARCH IN PROPRIETARY CONTEXT BY ANY OF PARTIES INVOLVED.

TABLE VI



BUILDING ON NATIONAL CENTER RESEARCH ANY COMPANY CAN ALSO ESTABLISH PROPRIETARY WORK LINKS WITH ANY UNIVERSITY.

Just to draw a comparison with the so-called advanced materials center proposed at Berkeley, we could finance 20-40 centers in the metals, ceramics, polymers with the highest quality science applied to traditional materials industrial problems.

ALTERNATIVE PROGRAM

INSTEAD OF $50 M/YR FOR LBL-MCAM, SAY 20M COULD GO INTO 6 CERAMIC RELATED CENTERS DEALING WITH HIGHWAY/BUILDING MATERIALS (4M) CERAMIC-ENGINE (7.5M) MAGNETICS (2M) TRANSDUCERS (2M) GLASS FIBERS (2.5M) BIOCERAMICS (2M).

But the materials research example is only one example of the illness afflicting U.S. R&D. I urge the Congress to consider the more general issues. I have summarized these in Table VII.

NEEDED CHANGES IN

S/T PROCEDURES

TABLE VII

- STEADY FUNDING; MINIMUM OF 5 YRS. (1st OF VANNEVAR BUSH'S RECOMMENDATIONS). CERAMIC ENGINE; RADIOACTIVE WASTE

  CONGRESS CAN SAVE BILLIONS OF DOLLARS AND HUMAN CREATIVITY BY LEGISLATING MINIMUM LENGTH OF CONTRACTS TO DIFFERENT PERFORMERS (FOR DIFFERENT KINDS OF RESEARCH).

- RADICAL CHANGE FROM PEER REVIEW OF PROPOSAL TO PEER-REVIEW ON QUANTITATIVE DATA OF PERFORMANCE.

  - RESEARCH PRODUCED IN PEER REVIEWED JOURNALS.
  - STUDENTS TRAINED (M.S. & PH.D.'S).
  - RESEARCH DONE AND PAID FOR BY INDUSTRY.
  - RESEARCH DONE FOR U.S. MISSION AGENCIES.

  (33-50% OF U.S. SCIENCE PERSONNEL IS WASTED ON THE REVIEWING PROCESS.)

- COMBINE INTO AN UPDATE OF CONGRESSMAN G. MILLER'S BILL.

- START A NATIONAL TECHNOLOGY POLICY

  GEORGE BROWN'S (HR481) IS AN EXCELLENT PLACE TO START.

We cannot continue the insanity of one year - even three month contracts to do research. That is equivalent to planting an apple tree in the Spring and cutting it down in the Fall of the same year. It is wasted time and energy with literally NOTHING achieved. If this Congress could devise mechanisms to insist that all University research be funded for much longer minimum periods it will have added 50% m.p.g. to our research automobiles.

The second biggest waste of U.S. R&D time is the arcane system for distributing research funds. My calculation shows that many research grants made on an RFP basis actually cost the nation more in lost time of 30 proposal writers than the award provides to 1 winner. We need a formula - like Congressman Miller's 1969 HR35 - based on peer-reviewed performance, NOT promises. I have devised such.

Lastly, when I asked Mr. Keyworth at the National Academy meeting on Materials Policy on Feb. 8, 1983, why the U.S. had no technology policy, he replied that "it was much more difficult." The U.S. has no technological guardian angel: without a technology policy, our technology will wither. I believe Congressman Brown's bill HR481 is an excellent beginning. I have only one complaint: I wish I had written it because it incorporates so many things I believe are essential.

Rustum Roy

Vita

Rustum Roy is Evan Pugh Professor of the Solid State and Professor of Geochemistry at The Pennsylvania State University. He also serves as Director of the Materials Research Laboratory, and Chairman of the Science, Technology and Society Program of the University.

Professor Roy is a crystal chemist specializing in the design, synthesis and preparation of new materials. He is the author of some 400 papers and several books. His work has been recognized by various awards and by his election to the National Academy of Engineering, and as a foreign member of the Royal Swedish Academy of Engineering Sciences. Professor Roy has been deeply involved in educational innovation, having played a major role in establishing geochemistry, and later materials science as academic disciplines on the campus, and recently in creating and directing the Science, Technology and Society Program. His work on new educational teaching materials has significance for the materials science and STS fields.

Professor Roy has been involved in science policy matters for two decades. He served three terms as a member of the Pennsylvania Governor's Science Advisory Committee. At the Federal level he has served on many panels, Boards and Committees of the NAS-NRC-NAE and the National Science Foundation. He has been a consultant to some industries continuously for twenty years. He has studied and written widely on matters of ethics and values. He was first chair of the National Council of Churches' Committee on Science, Technology and the Church, and in 1979 he was selected to give the Hibbert Lectures (in its Centenary year) in London, England, on the relationship of science and technology to contemporary religious insight.

Mr. GLICKMAN. Well, thank you, Dr. Roy and all you witnesses for your excellent testimony. I would like to start with a generic question, if possible. The Federal Government's intent is to concentrate its R&D efforts on long-term, high-risk and high-potential payoff activities of a wide generic application. Historically this is the stated intent while leaving responsibility for the shorter term applied R&D to the private sector.

Have you seen any indication that the materials industries, like minerals processing, metal producing, ceramics, et cetera, are capable of such action in today's economic atmosphere?

If any of you wish, you can run down the list, whoever wants to answer the question.

Dr. ROY. No, I think that is a fundamental error. The timeframe in which industry must react to the Japanese threat today is simply too short. If we don't provide Federal money through the universities, through the Government labs and industry working together on the 5-year-term problems, we will have no industry to pick up. What Congressman Ritter said earlier is correct. We absolutely cannot turn our backs on existing industry.

The only product of the administration's policy will be on-the-shelf science, that is all it will generate: papers. You know, we professors will get a longer bibliography. That is simply no policy at all. We have to get linkages to industry established right now to work on basic research on their identified problems with firm links into the system.

Mr. GLICKMAN. Dr. Mehrabian?

Dr. MEHRABIAN. Mr. Chairman, I think the rapid solidification that we have noted today is a very good example of a high-risk technology. The basic, generic science in this area is being conducted in the universities and in Government laboratories.

The second part of your question dealt with development of high-technology materials. There are some examples of some composites on the table there. For example, there are stanchions that go in the 757 aircraft, in the cargo bay. Those stanchions are made from a polymer matrix composite. That is a composite that was developed by industry; it is a Hercules composite. That is the kind of technology development that I think you were describing, sir.

Mr. GLICKMAN. My question was, does industry have the economic capacity to accomplish either the short-range or long-range R&D work without this kind of Government help?

Dr. FLEMINGS. I believe there is no industry of significant size in this country today that is working to any significant extent on the problems further than 3 years out. The basic materials-producing industries, there are few of them working beyond 18 months.

Mr. GLICKMAN. OK, now, let me go to the other statement. I think, Dr. Flemings, you mentioned in your testimony that not only the Japanese lead in ceramics markets—and you have a graph there. You also mentioned the areas that MITI is involved in, 6 of those 12 areas, are materials-oriented as shown in table 3 in your statement.

Dr. FLEMINGS. Yes.

Mr. GLICKMAN. What is your evaluation of the need to develop a Federal program to respond to the Government-industry initiatives taken recently in Japan, West Germany and other nations in the

areas of advanced materials? You mentioned, Dr. Roy, the MITI effort.

Dr. FLEMINGS. Let me talk to you a little bit about it. As I said before, the MITI effort is really nothing new. We have had it in the aerospace industry in America for a long time.

Dr. ROY. In defense, we have it even better.

Mr. GLICKMAN. We have MITI in defense perfectly. But even in the nondefense aerospace efforts, NASA's work in aeronautics has been unique in America, and there is joint industry-Government cooperation. They work together and decide what projects they are going to pursue. NASA is such an ideal model which doesn't exist anywhere else.

You mentioned the trees. This is a perfect place where you have a combination between the scientific tree and the technology tree. I know from experience, because my home District which includes Wichita, Kans., builds half the airplanes made in the world. Therefore I have a unique interest in the work done by NASA in this area. I am looking at the Japanese role, and am wondering what sort of a Federal program you see, organizationally or structurally that we can do—maybe not to copy the Japanese, because I am not sure that our cultures are not related enough to copy them——

Dr. FLEMINGS. I would be happy to respond to that.

I believe very strongly that we should have a program. I believe we should not try to copy the procedures or mechanisms of Japan, but I believe should copy two things:

One, the fact that they have such a program; and second, the fact that they have a focused program in what I would call technology-oriented research. It doesn't mean there isn't fundamental, long-range generic research that goes along with it.

But the overall programs are focused toward some technological objective, either new process or new products. Those two things, I think, should be the objectives of a major national effort in this area.

I think that if we were to develop such a program, I next think we should capitalize upon our strengths. And I have indicated some of those in my prepared text. But, specifically, I think there is a strong liaison, and a strong potential liaison between universities, industry, and Government.

The NASA model is a good one. I would only add to the NASA model a little greater role of the universities. It is not the university role has been insignificant. Not only small in NASA. It is only that in this forward-looking, broader area I would seek a stronger role of the universities.

Mr. GLICKMAN. One of the reasons for this is because the aircraft industry has become a mature industry. There is probably less feeling of need going out to the universities as in the past when in the developmental stage, because there is some university work being done, but you are right, not a tremendous amount. A lot is being done in their labs, such as the Lewis Lab, and the Ames Lab.

Dr. FLEMINGS. Right.

Mr. GLICKMAN. OK. Dr. Mehrabian, do you have any response to that?

Dr. MEHRABIAN. I would like to make a comment concerning the coordination of the materials activities in the country. We are

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spending something on the order of $1 billion in 15 different agencies. To try to coordinate all those activities under one banner would be very difficult.

However, by picking high-priority R&D areas, such as the ones I have tried to describe today, and in those specific areas where we anticipate that we can have technological breakthroughs, to put the kind of emphasis that Professor Flemings has described, I think we would be very successful.

Mr. GLICKMAN. Dr. Roy?

Dr. ROY. Mr. Chairman, I agree, of course; in my testimony, I show a model for precisely what Dr. Flemings is talking about. In fact, we do need a focus on what he calls "technology," and I call "applied materials research." We need to develop a coordination of existing strengths, and I think of the kind of program, say, at the Bureau on rapid solidification, where there is a lead agency and many other units involved. Our dielectric center at Penn State incorporates all those features.

I go back a long way with Defense Department support. They usually have a lead lab or unit which brings together all the other strengths, and coordinates that effort. They have many parts of the related industry sitting in on all the meetings. We have in the United States a half a dozen models which can be looked at, which are starting to operate now.

The key differences in these efforts are that they must focus on applied research, which means it is helping industry at the 3-5-year frame in coming together with new product developments. So that the key basic research, or the longer term is done cooperatively, and based on that, we spinoff the applied research which may be done in a proprietary mode.

We see that model in Japan. Some of my students are part of those Japanese efforts, and they are actually doing precisely that. Slightly shorter-range work is being done directly with the company; slightly longer range is done cooperatively with Government and industry. We always try to use existing strengths, never invite proposals.

One thing I abhor is incompetence having to resort to a request for proposals [RFP]. If a manager can't find the best guys in the United States, with half a dozen telephone calls and a visit or two, we should fire him. My new book will show you the data on how many RFP's, constitute for the Nation a negative award. A new Defense Department's instrumentation program is a net loss to the United States, with a ratio of some 21 to 1 in proposals received to those funded. You can cost that out and show that is true. Research managers should manage and make decisions otherwise we should eliminate them.

Mr. GLICKMAN. Listening to you three speak, I think it would be helpful to the staff, when they write the report, to do a brief inventory or assessment. This assessment would concern the major Federal materials programs, listing them by function, laboratory, agency, and how much is being spent. We are talking about 15, 16, or even 17 major operations, whether they are at laboratories, or at NASA, or at Department of Energy, or whatever.

Dr. MEHRABIAN. Mr. Chairman?

Mr. GLICKMAN. Yes?

Dr. MEHRABIAN. There is a subcommittee of COMAT entitled Materials R&D Inventory, which reports to Dr. Keyworth, in OSTP. This subcommittee has just completed such a study. I think it is now in the review process. It was mentioned by Dr. Keyworth 2 days ago, and I am sure that will be available to the committee.

Mr. GLICKMAN. I hope so, but given past experience with the speed at which they complied with our committee's requests, I am not sure. In some way, I think that our committee report ought to reflect that inventory of major items. I would like to just move on to one other thing and then I am going to recognize Mr. Ritter. Afterwards I am going to come back for questioning.

I remember when we were having our subcommittee authorizing discussions of the lab, the new lab at Lawrence Berkeley Laboratory, and some of the NASA people told us, "Hey, that is a surprise to us. We never even knew that that was in the works. I think we do some of that stuff already." I am concerned about what—was said but I don't remember which one of you talked about this. That is the process by which we decided that we were going to create a new "Materials Lab" because we needed to devote effort in this area without relating it to some sort of technology transfer. I wonder if you have any ideas on the structure we ought to use in the Government itself to try to coordinate materials research. I mean, we have a COMAT, I realize that. We have a lot of things. But, I mean, should we give the new laboratory to NASA, and let them be a focal point for materials research? Should we have all sort of labs working on it, do we need to make any changes structurally? I am not talking about money, nor am I talking about some of these issues that you raised on philosophy. I am talking about government structure.

Does anybody have any ideas? We have our NBS person right here, maybe he doesn't want to comment on that.

Dr. MEHRABIAN. I will by happy to.

I think that the different laboratories, the national laboratories, bring different strengths to the materials field. NBS bring a unique strength. It works closely with industry. It has certain programs that are very strong. Its nuclear reactor is used by many researchers, public and private. The Oak Ridge Laboratory has a high temperature program that is very good.

There are other laboratories in the country that specialize in different areas. Building on those strengths is what would be important. To have a singular location for everything would be very difficult to do. We can't move all the materials scientists, even to Kansas.

Mr. GLICKMAN. Does anybody else have any thoughts on that?

Dr. Roy?

Dr. ROY. I have a thought which is a congressional thought. I believe that Congressman Brown's H.R. 481, the new national technology bill, which he has introduced for the past three or four sessions has never been called to hearings. I am not sure that is exactly the way that we must do it. But we do need a structural change in U.S. research policymaking. We absolutely must have a structural change, and I believe the kind of thing that Don Fuqua promised, that we should hold some hearings this year, on the structural change would be invaluable.

I suggest that George Brown's bill is an ideal vehicle for such a debate. I support a lot of it. The bringing together of a focus for what we call our intermediate-range work. Let NSF have the longer-range on-the-shelf science producing role. It is a very valuable, important role.

But the National Technology Foundation is to look at the 3-to-5-year kind of frame. It proposes to bring together the Bureau of Standards as the core, to put around it a university connected engineering directorate (from the NSF) and to give it the kind of support to build all kinds of new centers. It has all those features.

And so I would say, a structural change that I find extremely satisfying is something like Brown's 481. And I think calling that to hearings, would give the Congress the focus which we need.

Mr. GLICKMAN. Dr. Flemings, did you have a comment?

Dr. FLEMINGS. I was going to say that I am, by no means, an expert on governmental organization. I do have a feeling, somehow, that we need less a structural change. That we need to focus on our strengths and find new ways to build on this Government-university-industry relationships.

Whether that requires a new structure or not, I am not so clear.

Mr. GLICKMAN. OK. I am going to turn it over to Mr. Ritter now for questions.

Mr. RITTER. Thank you, Mr. Chairman.

I would like to thank our panel for some excellent testimony. I, frankly, was not going to be here more than a half-hour into the session, but I decided to cancel our normally competing three other events to stick around and listen.

Dr. Roy, you make a comment in your testimony to the effect that if industry doesn't put up money on the line, in terms of trying to advance technology through R&D, then the project isn't worth anything.

When a company looks over a university lab, and plunks down $50,000 to support some research, that amount is the most effective, most honest, most detailed peer review. I tend to agree with that, and I tend to agree that the kind of programs that NBS has been successful in fostering have had a strong industry commitment. When you really look at the Japanese experiment, or the Japanese model, it is really a very, very close interaction of process, product, market, sales, right down the line.

And there is a tremendous involvement from industry. I look at the 10 years that we have just gone through with somewhat of a critical eye. I, frankly, just don't feel it is a question of money at all.

I know people who are talking about putting new money here and new money there. Money can always help expand the total pie, but if the pie has the wrong flavor and no one is eating it, maybe money is not the important ingredient.

We have done that. We have expanded the Federal role in research and development significantly. And during that same period of significant expansion, I might add, having been at one of our university research laboratories myself, the outcry has been that the budget has not grown by a sufficient increment. That it should grow at 8 percent versus 6.2 percent, or 8.4 percent versus 5.8 percent. I submit that that is not the problem.

The problem is that, as Dr. Roy points out, as NBS is proving, and as Dr. Flemings is saying, there has to be an intimate relationship between the producer and seller in order to make this functional.

If we can learn one thing from the Japanese, we can learn that that is the relationship that has to be fostered. The Baruch report, talked about this. Although it tried to sidestep some of the more difficult questions, it did come up with the idea that industry has to be putting up some of the cooperative venture capital, so to speak, in these R&D ventures.

And I think we will end up with a far better product. Now, the question is, and it is a question for university labs and government labs as well, do we simply say,

Well, do we need this much more money in order to have industry come into the picture?

Everything we do today is just perfect, and there shouldn't be any changes, but in order to make this model work, we must have vast new expansions of the Federal R&D seed money input.

Dr. Roy makes another point in his report: That one could reprogram and reorganize the current expenditure of vast Federal resources in a way that is more stimulative of industry's input, and ask industry to come up and match and pay its share of the role in fostering advance in technology.

I would like to hear comments from the panel on that, many of whom are either presently at universities or have been at universities.

Dr. ROY. Don, the problem is, you are speaking to the converted. You see here universities which are deeply involved with industry. Of course, we support what you are saying. I believe the Bureau of Standards, by its record, has demonstrated that, but I don't think the Federal agencies really see that role of stimulating interaction as one of their primary missions.

I did say in my testimony I believe we could do it with zero increase of funds. It is not money. I happen to agree with that. It is reprograming. But it means reprograming people and agencies. In saying this is a worthy objective, that our objectives should be changed from merely supporting research to supporting the kinds of research and development, cooperatively, which will generate major new jobs and generate products and all those things, we give a signal to the universities.

Now, that means a change in university values, because that is a very hard thing to reconcile with prevailing values. However, just reprograming the money to emphasize this kind of research would work miracles.

Mr. RITTER. This is another interesting point. The professorial values are not necessarily producing products with sales in the marketplace. And so one begins to question whether or not these values that we do find in the professorate, to which I have belonged, at times conflict with the end goal of impacting the marketplace.

The professorate value is the publication. It is the research grant. It is not an impact on the marketplace. And this is why redirection and reprograming of some of our existing resources in the direction which requires an industry involvement in the cost of the

project, requires that kind of "peer review" that comes with industry slapping down $50,000 in a project.

Not in all areas, obviously. There are certain basic sciences that will not be affected. But I think there is plenty of room for reshaping existing, vastly expanded resources. If you are looking at the last 10 years, it means reshaping those resources to accommodate the goals of product and market and sales and cost.

Because with just the Government working with the universities alone. Somebody has to be judging some of the research of the universities, other than professional journals if you want to impact on productivity and the marketplace.

Dr. FLEMINGS. I agree, if I may respond. In the last—10 years ago, at MIT, about 5 percent of our total research support came from industry. Today, that number is up to 11 percent, and it continues to grow. Still small, compared with Government research, but the number is significant and growing.

Industry, of course, supports us in other ways than research. They support us with endowed professorships and with funds and with gifts that are very important, but they support us to the tune of some 11 percent in research, and higher than that in the materials field.

We find, I might say, that our best interaction occurs with industry. And in my opinion the way that we can serve industry and the Nation best is not by focusing on near-term results, although those often come out of the research activities.

But, instead, by focusing on real industrial problems and tackling generic aspects of those problems, tackling aspects of those problems that may not be directly proprietary to any individual company, but that lay the broad technology, the broad—even in some cases, scientific understanding that will help them develop new processes and new products.

We have, at the moment, a consortium of companies that is now nearly complete and being formed, and they will be approximately 30 companies as a member of that consortium that will give to our Department—I shouldn't say give—that will buy from our Department, if you will, an extended effort in development of new technology in the ceramic area, primarily for electronic materials, one run by Ken Bowen, and that is to the tune of $1 million from industry, directly not to solve a specific problem, but to establish the generic technology which will let them then, in their companies, develop better processes and better products.

To the extent that Government can help us develop and improve and strengthen these relationships, that would be a magnificent thing for us and I believe for the country, and I believe there are significant ways in which the Government can work with us to help us develop and make these relationships more fruitful.

Mr. RITTER. Thank you.

I just have one closing comment, too. I think, in addition to the national laboratories, the NBS's and the universities, we have to consider very forcefully how we can internalize more research and development within American business and industry itself.

There you have a variety of economic forces which have a major impact, but if you look at the Japanese model again, a far greater share and percentage of their research and development, this prod-

uct-oriented, process-oriented, market-oriented research and development, is occurring in-house in the industries. And they will use academia, and various Government installations, but if you look at the numbers, it is weighted very substantially internally inside the private sector. While our basic R&D and priority is weighted very substantially outside the private sector and inside universities and national labs.

I think the economic policies, particularly tax policy, that foster investment are the incentives that will play a major role outside of the universities and the national labs to determine if we are going to maintain any kind of position at the cutting edge, because it is in that private sector, where the sales will eventually be made.

I thank the chairman.

Mr. GLICKMAN. Thank you, Mr. Ritter, for that excellent comment. Let me just ask you a couple of quick, closing questions. Bell Labs has been responsible for, I think it was Dr. Flemings who talked about some of the work in fiber optics—do any of you have any feelings as to the divestiture of the Bell System? Is it going to affect the ability of Bell Labs to do the kind of research that they have been doing in the past?

They have been the perfect example of an in-house lab that has been able to transfer a lot of their technology and have run their labs, rather independently.

Does anyone have any feelings about what is going to happen to Bell Labs, and their ability to continue to do research, or is there any concern that we will begin to see problems due to the deregulation of the communications industry?

Dr. ROY. Yes. In the Bell Labs and IBM are our little MITI's, they are internal MITI's. And I think if we study the structure, as Ms. Shapley and I have just finished doing in our book "Lost at the Frontier: American Science and Technology in Trouble," we find that the Bell Labs was an integrated ladder from basic research to product. It has been checked out by the Bell Labs people for many outsiders have a complete misconception about Bell Labs. They think that they are all doing all basic research, sitting around on their cans, thinking noble thoughts. That simply isn't true. Bell Labs is an integrated system, and there is therefore a slight danger in the breakup of Ma Bell. If critical mass is lost in the subassemblies and I am using it—in the technical sense we will suffer. I don't think Bell has been broken up that far. If that happens, we will suffer.

If each subassembly is big enough to handle a system from basic science all the way to the product, they have got it made.

I believe that if that is hurt, then the Nation will be hurt; if it is still big enough, maybe we will be OK.

Mr. GLICKMAN. I think, Mr. Ritter is on the authorizing committee that dealt with that issue.

Mr. RITTER. Just a quick comment. As we dealt with the bill, 5158, which was the AT&T bust-up bill, this was a very strong point. But the interesting thing was that it was this Congress, and forces within this Congress, including interest groups seeking to move in on that which AT&T would have to give up, which made a very powerful attempt, to derange or to derail that most successful of internal industrial research laboratories.

Mr. GLICKMAN. The final question I wanted to ask relates to COMAT. It was Dr. Mehrabian, I think, who mentioned the initiative for rapid solidification technology, and he referred to COMAT. I am wondering, if that came out of your work or did the initiative come out of COMAT, or did rapid solidification technology really come out of the Commerce Department as the one who developed it, and COMAT ratified the method to make it look like it was doing some good.

I may be letting my prejudices show now, so I will try to ask the question as objectively as I can. I am concerned about the effectiveness of the COMAT, the Cabinet Council mechanism, and I thought that if you or anybody else who has any feelings about that or know something specifically about COMAT might talk about it briefly and also about this particular initiative. Didn't it come out of the Commerce Department?

Dr. MEHRABIAN. I think the history of that specific task group in COMAT was that it was a working group that was appointed specifically for that area, to coordinate that area, by the COMAT committee.

The chairman of that subcommittee came out of the Defense Department, he is Mr. Jerome Persh. We, in the Department of Commerce and NBS have played a strong role in technical coordination. But I think activity, credit for the activity, has got to go back to COMAT and OSTP.

Mr. GLICKMAN. I want to thank all of you for coming and the excellent testimony. I think this is very useful. One thing that is useful is we are not in session, therefore we don't have to leave every 10 minutes to go and vote, This lets us develop an issue in some depth, and I am not sure what, if anything, we are going to do legislatively, but I think we have developed some raw material for the appropriate oversight function to try to redirect some of the existing mechanisms in a more appropriate role, and who knows, maybe legislatively as well. We thank you for your excellent testimony today. Mr. McCandless, did you have anything you wanted to say.

Mr. MCCANDLESS. Well, Mr. Chairman, I apologize. We had a little action on the floor this morning between the Speaker and one of the 1-minutes, and I was standing by in case there was need to get involved. I apologize for the people—

Mr. GLICKMAN. I am glad you were protecting the interests of all of us down there.

Mr. MCCANDLESS. Hopefully, all of the interests of all of us.

Mr. GLICKMAN. All of the interests, OK.

Our next witness, and actually our last witness in this series of hearings, is Hope Babcock with the National Audubon Society, and I am appreciative that you were able to be here. I hope that—you were on yesterday, you know.

Ms. BABCOCK. I did, and I apologize——

Mr. GLICKMAN. Whatever, it is fine. This way, you actually have more time, and you are all to yourself now. You would have had to have——

Ms. BABCOCK. It is lonely.

Mr. GLICKMAN. Pardon?

Ms. BABCOCK. It is lonely. I like being on a panel better.

Mr. GLICKMAN. OK. Well, we are pleased to have you here.

Ms. BABCOCK. Thank you.

Mr. GLICKMAN. Since you have been here before and on this same subject, I think, at one time when I chaired a hearing on materials.

Ms. BABCOCK. That is correct.

Mr. GLICKMAN. You may feel free to summarize your statement if you wish. It would be helpful to us so we can get more into questioning.

Ms. BABCOCK. Sure, I will take advantage of that invitation.

I would have liked to have blamed my nonappearance yesterday, and my confusion on the frailties of being a member of the weaker sex, but I was afraid I could not get away with that.

Mr. GLICKMAN. We wouldn't believe that anyway.

STATEMENT OF HOPE M. BABCOCK, NATIONAL AUDUBON SOCIETY

Ms. BABCOCK. I knew you wouldn't, and might not consider my testimony of any consequence if I tried that excuse.

Well, as you pointed out, Mr. Chairman, I am here today represented the National Audubon Society. Audubon is nonprofit, nationwide organization with nearly a half-million members. The society is concerned with promoting the wise use and conservation of our natural resources.

I appreciate having this opportunity to appear before you today on our concerns relating to surveying activities on public lands.

Audubon has had a long-standing interest in maintaining the integrity of these lands, and hence, in the impact of minerals activities on public lands.

The focus on this hearing is an important step in underscoring the potential threat unwarranted or unrestricted mineral exploration development activities can have to our fragile natural resources and a better understanding how to limit problems in advance of their occurring.

I would like to begin by summarizing Audubon's overall position on mineral resource development and the Nation's public lands.

First, Audubon does not believe that there is any linkage between withdrawal of public lands for environmental reasons and the so-called crisis in the availability of strategic minerals, and that therefore, there is no need to accelerate access to these lands to achieve the elusive goal of national minerals independence.

Second, Audubon agrees with Hans Landsberg, noted resource economist in Resources for the Future, in his criticism of the search for a comprehensive national minerals policy, when he called it, at best, an elusive, and at worst, a waste of time.

Preoccupation with research draws attention away from other more immediate problems facing the domestic minerals industry, some of which I think you have heard at these hearings, and the attendant hype inevitably results in unwise proposals to accelerate access to our public lands.

Third, Audubon believes that there is much too much emphasis on getting minerals out of the ground and not enough on industrial processing of those materials, as well as on substitution, recycling,

and conservation techniques, some of which the preceding panel has addressed with much eloquence, I thought.

More, not less, money should be spent on R&D in these areas as we look for ways to modernize our industrial base.

Fourth, Audubon believes that we do not now have an adequate Federal regimen for regulating hard rock mining on public lands, because the basic statutory framework is not there. The mining law of 1872 contains no environmental, economic or health and safety standards for hard rock minerals.

Nor do the planning and balancing standards of the Federal Land Policy and Management Act apply to those same materials.

Only some of the pollution-causing aspects of hard rock mining are regulated under our basic pollution control laws, while others, such as erosion, noise, scarification of the land surface, are reached, if at all, by local or State requirements.

From this perspective, let me turn to what we believe are important environmental policy concerns related to exploration for mineral resources on public lands. There are two very different reasons for engaging in mineral exploration work.

These are: Exploration for the purpose of assessing an area's resource potential and exploration for the purpose of identifying a commercially minable deposit.

Exploration for the purpose of assessing the resource and development potential of certain geographic areas provides important information for estimating domestic production capabilities versus foreign supply, and helps establish priorities in research for alternatives.

Increasingly sophisticated area-wide assessment survey techniques, such as remote sensing or airborne techniques, many of which we described in industry testimony the other day, provide increasingly detailed information on the location of mineral resources with minimal environmental impacts as no subsurface activity is necessary.

I also list some of those techniques in my written testimony. Further, because resource survey activity is often pursued just for the resource information itself, rather than for purposes of later development, it is possible to view the impacts of these activities as limited to those generated by the survey work itself.

However, since mineral deposits are becoming harder to find as the more accessible resources are developed, this type of technology must constantly improve just to keep pace.

Like the remote sensing techniques, most surface survey work employed for preliminary identification of mineral deposits is not environmentally damaging. Biogeochemical, geobotanical, methods of analyzing surface data involving both visual and chemical analysis of plants and humans have been refined during the last 20 years.

Air and vapor sampling techniques are expected to become increasingly useful as greater understanding of trace metal dispersion is developed.

When remote sensing or airborne techniques are combined with surface survey field work, a basic body of information can be developed regarding regional geology and identification of anomalous areas.

It is our view that these types of informational surveying activities can be carried on virtually anywhere on the public lands without causing undue environmental damage, and should be encouraged.

In contrast, exploration for the purpose of identifying a commercially minable deposit which requires subsurface activity, results in impacts to the environment which can be both significantly damaging and in many cases, unacceptable.

I would like to point there that I think claims by industry the other day that these impacts are transitory are somewhat misleading. While they may be taking place over a short period of time, the impact itself can be of long duration, such as contamination of an aquifer or of permanent or serious effects, such as interrupting the breeding habits of certain wildlife species that you would be concerned about.

Further, unlike exploration for assessing resource potential, it is misleading to evaluate the impacts of such exploration in isolation. When this type of surveying work is undertaken, it is with the understanding that if commercially-valuable resources are found, there will be a strong interest in proceeding with development.

In other words, there is a continuum moving from exploration for commercially-valuable resources to actual development. It is at this point that specific resource targets are identified that drilling and/or trenching become critical to exploration, and with these activities come a variety of unacceptable adverse environmental impacts.

For example, geophysical surveys involve explosive methods that can cause both burning and noise impacts. Seismic or thumper work generates noise, shock and vibration effects. Both techniques can have significant adverse effects on wildlife, particularly during sensitive times of the year, such as calving or mating seasons.

The purely esthetic, visual impacts of these activities and otherwise pristine areas also cannot be disregarded, particularly in areas important for their recreational or solitude values.

The core drilling which accompanies geophysical and geochemical testing requires access roads, large equipment, and the demarcation of grid lines. Modern water requirements for drilling activity can be quite extensive, depending upon the drilling method selected.

In turn, waste pits for mud and drill cuttings are needed for each drill site. Damage to vegetation, scarring of the landscape, destruction of wildlife, water and air pollution are all impacts to one degree or another, exploratory drilling.

As this discussion illustrates, the impacts of the later stages of mineral exploration cannot help but be detrimental in environmentally sensitive areas. There are several recommendations which we feel can be made to resource policymakers and land managers which would minimize such impacts.

First, Congress and the land management agencies should be willing to make land classification decisions based on reasonably available resource data.

Surface surveys, both aerial and on-the-ground, should provide sufficient mineral resource information to make basic classification decisions as to wilderness or nonwilderness areas.

Leaving sensitive resources unprotected in areas which are fully qualified for designation as wilderness areas, or as units of other protected land management systems, simply because of a perceived lack of mineral resource data, unfairly jeopardizes these resources, by they water, wildlife, wild forests or desert land.

Second, to give Congress sufficient data to arrive at the above classification decisions in the years ahead, every effort must be made to accelerate research and development efforts which will result in improving preliminary survey techniques.

Third, as the Government investigates various mechanisms to assure the viability of the minerals industry, as part of our defense and our industrial base, emphasis should be placed on research and development assistance for survey techniques.

The long-term benefits of such funding would outweigh those of some of the current proposals to subsidize mineral projects in areas which are currently uneconomic to develop, at least in part because of their inaccessibility or environmental sensitivity.

Fourth, maximum research and development effort should also go into development of alternative materials for the mineral resources for which our domestic supply are scarce. Substitution and recycling alternatives should be pursued aggressively, and the mineral production industry should be encouraged to take increasingly active role in pursuit of such alternatives.

In conclusion, it is our view that there will always be areas which, because of their outstanding wildlife, wilderness, watershed, scenic, or other natural values, deserve comprehensive protection from damaging activities, such as full-scale mineral exploration.

It will continue to be the responsibility of the Congress and the agencies which have stewardship over these lands to protect their natural values for the Nation as a whole, and for generations to come.

Because minerals survey work has become vastly more sophisticated in the last couple of decades, and clearly can become more so, we urge this committee to look to ways which research in this area can be speeded up.

Not only would we stand to reap environmental benefits from such survey breakthroughs, but the Nation's capability to make sound decisions regarding strategic materials and mineral needs on our public lands will be greatly enhanced.

Thank you.

[The prepared statement of Ms. Babcock follows:]

TESTIMONY OF HOPE M. BABCOCK
DEPUTY COUNSEL & DIRECTOR OF PUBLIC LANDS AND WATERS PROGRAM
NATIONAL AUDUBON SOCIETY
BEFORE THE SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

MAY 18, 1983

My name is Hope M. Babcock. I am Deputy Counsel and Director of the National Audubon Society's Public Lands and Waters Program. National Audubon is a nationwide, non-profit organization of nearly one half million members who are dedicated to promoting the wise use and conservation of our natural resources and protection of the environment.

I appreciate having this opportunity to appear before you today on the question of domestic mineral resources and, in particular, on our concerns relating to surveying activities on public lands. Audubon has had a long-standing interest in maintaining the integrity of our public lands and hence in the impact of mineral activities on those lands. The focus of this hearing is an important step in underscoring the potential threat unwarranted or unrestricted mineral exploration and development activities can have to our fragile public natural resources and in better understanding how to limit problems in advance of their occurring.

I would like to put my discussion of mineral exploration techniques in the context of what the National Audubon Society views as important considerations relating to development of mineral resources on the nation's public lands.

First, the National Audubon Society does not believe that there is any linkage between withdrawal of public lands for environmental reasons and the so-called crisis in the availability of strategic minerals. We do not deny the importance of creating and maintaining a strong domestic hard rock mining industry and of an assured and viable supply of critical industrial minerals and materials. However, we do not think that accelerating mineral development on our public lands to the detriment of the protection of those lands will be a significant factor in securing these supplies or an appropriate price to pay to achieve our elusive goal of national minerals independence.

Second, the Society does not support what Hans Landsberg, noted resource economist at Resources for the Future, calls "at best an elusive and at worst a waste of time" search for a comprehensive national minerals policy. The dissimilarites between types of minerals and materials as well as extraction and processing techniques make the achievement of such a policy impossible. Those who call for a comprehensive policy are, in part, relying on non-existent parallels between recent energy production history and the minerals industry. Minerals occupy a smaller share of the country's economy, offer relatively inexpensive stockpiling opportunities and can be recyled, in contrast to energy products. Preoccupation with this search draws attention away from other more immediate problems facing the domestic minerals industry and the attendant "hype" inevitably results in unwise proposals to accelerate access to our public lands.

Third, we believe that there is entirely too much emphasis on getting minerals out of the ground and not enough on industrial processing of those materials, their substitution, recycling and conservation techniques.

More, not less money should be spent on R & D in these areas as we look for ways to modernize our industrial base. Any proposals to erect trade barriers or otherwise subsidize the minerals industry or the consumers of those materials must be linked to improvements in these areas.

Fourth, we do not now have an adequate regimen for regulating either exploration for or extraction of minerals on public lands, because the basic statutory-framework is not there. The Mining Law of 1872 contains no environmental, economic or health and safety standards for hard rock minerals. With regard to environmental concerns, only some of the pollution causing aspects of mineral activities are regulated under our basic pollution control laws (the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act); while others, such as non-point source pollution, noise, destruction of the surface of the land are reached, if at all, by local or state requirements. Lands subject to mineral location or patent are removed from the basic Federal planning system under the Federal Land Management and Policy Act. This means that these lands cannot be managed as part of our national inventory of natural resources under a multiple use/sustained yield standard, one goal of which is the avoidance of permanent impairment of the land's productivity. Yet, certainly with respect to mining and, to a lesser extent exploring for these minerals, the environmental and socio-economic effects are considerable and one not infrequent result is permanent damage to the land's surface.

With these concerns in mind, let me now turn to what we believe to be important environmental policy concerns relating to exploration for mineral resources on public lands.

The driving momentum behind mineral exploration is, of course, economics. It is, perhaps, a slight oversimplification to say that the more costly levels of mineral exploration are also the most environmentally damaging. By and large, however, this is the case and should tell us two things. First, there are some built in safeguards for the environment in the economics of mineral development; i.e., development should not proceed where it is uneconomic. But, second, because the investment in a potential mineral resource grows steadily with more thorough exploration, the commitment to production increases through time, if a deposit is discovered.

There are two very different reasons for engaging in minerals exploration work, which reasons, in turn, have a great deal to do with the type of surveying conducted and the resultant environmental impacts. These are exploration for the purpose of assessing an area's resource potential and exploration for the purpose of identifying a commercially mineable deposit. Environmental planning and regulation efforts are complicated by the fact that exploration activites for commercial deposits proceed along a continuum from prospecting to development, each step dependent on the results of the one before it. While it is true that the success rate for bringing a mineral prospect identified for exploration by private industry all the way to the profitable mine stage is very low (some calculations indicate an 0.7% success rate);[1] this does not reduce the uncertainty regarding where, along the prospecting-to-development continuum, environmental impacts may be incurred once exploration gets underway.

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[1] Exploration, Mining and Geology, William C. Peters, University of Arizona, 1978.

Exploration for the purpose of assessing the resource and development potential of certain geographic areas serves two important functions. Within the context of meeting the nation's materials needs, such evaluations provide important information for estimating domestic production capabilities versus foreign supply. They also help in establishing priorities in research for alternatives.

Increasingly sophisticated assessment survey techniques provide increasingly detailed information on the location of these resources and can result in minimal environmental impacts. Remote sensing and surficial analysis techniques have become more sophisticated, particularly in the past 10 to 15 years, so that the quality of information that can be obtained without subsurface activity has improved. A number of airborne scanning systems including thermal, infrared scanning and radar techniques are being employed currently with some success. Satellite imagery from the Landsat satellites is also being used in conjunction with aerial photographs. Geologic mapping information, selection of areas for reconnaisance and preliminary project reconnaisance can all be conducted from the air; often more economically than if on-the-ground survey techniques are employed in the preliminary stages.[2] Further, because this type of survey activity is often pursued just for the resource information, rather than for purposes of later development, it is possible to view the impacts of these activities as limited to those generated by the survey work itself. However, since mineral deposits

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[2]"Mineral Exploration," in Industrial Geology, O. W. Nicholls, 1978.

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are becoming harder to find as the more accessible resources are developed, this type technology must constantly improve, just to keep pace.

Like the remote sensing techniques, most surface survey work employed for preliminary identification of mineral deposits need not be environmentally damaging. For example, field survey techniques restricted to surface activity include sampling of numerous sources, e.g., rock, soil, glacial debris, stream and lake sediment, surface and ground water, snow, vapor and vegetation without adverse environmental consequences. Biogeochemical and geobotanical methods of analyzing surficial data, involving both visual and chemical analysis of plants and humus, have been refined during the last 20 years. Air and vapor sampling techniques are expected to become increasingly useful as greater understanding of trace metal dispersion is developed.[3]

At present, when remote sensing or airborne techniques are combined with surficial survey field work, a basic body of information can be developed regarding regional geology and identification of anomalous areas. It is our view that these types of informational surveying activities can be carried on without causing undue environmental damage virtually anywhere on the public lands. From both an environmental protection perspective and an economic perspective these would appear to be the exploration techniques most important to refine and improve to provide better information regarding subsurface deposits without disturbing the earth's surface.

In contrast, exploration for the purpose of identifying a commercially mineable deposit which requires subsurface activity, results in impacts to the

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[3]Ibid

environment which can be both significantly damaging and, in many cases, unacceptable. Further unlike exploration for assessing resource potential, it is misleading to evaluate the impacts of such exploration in isolation. When this type of surveying work is undertaken, it is with the understanding that if commercially valuable resources are found there will be strong interest in proceeding with development.

The geophysical and geochemical survey techniques which are brought into play as specific resource targets are investigated, tested and evaluated are significantly more costly than remote sensing or "hands-off" techniques, both economically and environmentally. It is at this point that drilling and/or trenching becomes critical to exploration, and bring with them a variety of adverse environmental impacts. These techniques vary depending upon terrain and climate conditions. I will not go into detail here regarding the different drilling techniques and accompanying equipment needs or requirements for roads, field grids or explosives, but I do want to highlight in general terms for the Committee some of the effects which accompany, to one degree or another, the various forms of subsurface exploration.

Geophysical surveys involving explosive methods can involve both burning and noise impacts. Seismic or "thumper" work generates noise, shock and vibration effects. Both techniques can have significantly adverse effects on wildlife, particularly during sensitive times of the year such as calving or mating seasons. Shock and vibration effects can also cause disruption of fisheries. The purely aesthetic, visual impacts in otherwise pristine areas also cannot be disregarded, particularly in areas important for their recreational or solitude values.

The core drilling which accompanies geophysical and geochemical testing requires access roads, large equipment and the demarcation of grid lines. Mud and water requirements for drilling activity can be quite extensive, depending upon the drilling method. In turn, waste pits for mud and drill cuttings are needed for each drill site. Damage to vegetation, scarring of the landscape, disruption of wildlife, water and air pollution are all impacts, to one degree or another, of exploratory drilling.

Sampling activities are conducted in part through core drilling. Placer work, involving shafts, trenching and large quantities of water, and bulk sampling, which can require entire train load shipments of sample material, cause significant environmental impacts as well.

The impacts of the later stages of mineral exploration cannot help but be detrimental in environmentally sensitive areas. There are several recommendations which we feel can be made to resource policy makers and land managers which would minimize such impacts.

(1) The Congress and managing agencies should be willing to make land classification decisions based on reasonably available resource data. For mineral resources, surface surveys, both aerial and on-the-ground should provide sufficient information to make basic classification decisions. Leaving other sensitive resources unprotected in areas which are fully qualified for designation as wilderness areas or as units of other protected land management systems simply because of a perceived lack of mineral resource data, unfairly jeopardizes other dwindling resources be they water, wildlife or wild forest or desert land.

(2) To give Congress sufficient data to arrive at the above classification decisions in the years ahead, every effort must be made to accelerate research and devlopment efforts which will result in improving preliminary survey techniques. Computer analysis and deposit modeling are, for instance, techniques which are only beginning to be applied to assessment of mineral resources. Already they are becoming useful tools for identifying locations for further subsurface work. Aerial techniques such as side-looking airborne-radar (SLAR) and their use in conjunction with both satellite imagery and surface surveys continues to advance in sophistication. And yet R&D efforts in the hardrock minerals field do not seem to focus as much as they might on these critical aspects of exploration technology.

(3) As the federal government investigates various mechanisms to assure the viability of the minerals industry as a part of our defense and industrial base, emphasis should be placed on research and development assistance for survey techniques. The wisest investments would be those which result in improving the capability for pin-pointing developable deposits while minimizing the need for costly and environmentally damaging drilling and other subsurface activity. The long-term benefits of such funding would surely outweigh those of some of the current proposals to subsidize mineral projects in areas which are currently uneconomic to develop, at least in part because of their inaccessibility and environmental sensitivity.

(4) Maximum research and development effort should also go into development of alternative materials for the mineral resources for which our domestic supplies are scarce. Substitution and recycling alternatives should

be pursued aggressively, and the mineral production industry should be encouraged to take an increasingly active role in pursuit of such alternatives.

In our view there will always be areas which, because of their outstanding wildlife, wilderness, watershed, scenic or other natural values, deserve comprehensive protection from damaging activities such as full scale mineral exploration. It will continue to be the responsibility of the Congress and the agencies which have stewardship of these lands to protect their natural values for the nation as a whole and for the generations to come. Because mineral survey work has become vastly more sophisticated in the last couple decades, and clearly can become much more so, we urge this committee to look to ways in which research in this area can be speeded up. Not only would we stand to reap environmental benefits from such survey breakthroughs, but the nation's capability to make sound decisions regarding strategic materials and minerals needs would be greatly enhanced.

Thank you.

Mr. GLICKMAN. Thank you very much. I appreciate your testimony and your interest. I have just a couple of questions for you.

First, I want to clarify something in your statement. You quote Hans Landsberg, who calls "at best, an elusive, and at worst, a waste of time the search for—" and you put in your statement a national minerals policy.

Ms. BABCOCK. Right.

Mr. GLICKMAN. Now, actually, the statement that he made was a national materials policy, because we have this quotation.

Ms. BABCOCK. OK.

Mr. GLICKMAN. Now, I want to emphasize to you that—but then he goes on in his statement and says, "We need to significantly redouble our efforts in materials." I also want to emphasize, this committee is not committed to formulating one general policy statement to cover all the materials issues but we are interested in materials, not minerals as the base foundation issue.

Ms. BABCOCK. I understand.

Mr. GLICKMAN. We are interested in the use of these materials for, the substitution as well as all the items that you are talking about in your point No. 4 as part of that policy. What we are concerned about is developing an effective, permanent mechanism for providing a coordination of Federal materials efforts for priority-setting, criteria, decisionmaking, stockpiling, and substitution. Obviously, minerals issued have to be part of this also.

I didn't know that related to your statement, because, the environmental concerns are part of that materials issues, but——

Ms. BABCOCK. Right. If I could go back to Mr. Landsberg's statement. What he was focusing on were the diversities, basically, in

the materials area, and complaining about the attempts, I guess, in this most recent Administration to try to pull everything together as though all of the procedures for processing of these materials and the markets for them are all the same—while in fact each one has its own unique properties—and the mistakes of trying to parallel what we are doing now in materials to what the recent history in the oil and gas energy area has been where a comprehensive policy perhaps make sense——

Mr. GLICKMAN. Yes.

Ms. BABCOCK [continuing]. That it breaks down——

Mr. GLICKMAN. I don't think that this committee is calling for a comprehensive policy, because there isn't one. What we are trying to figure out is we need to somehow do assessments of what our materials needs are, and we have many laboratories which are doing research and having the right hand know what the left is doing obviously—what I am saying is that I don't think anything he said contradicts to what we are talking about here.

Ms. BABCOCK. Not at all. It was, I think, a criticism directed more at the current administration and focusing—again, I don't want to put words into Mr. Landsberg's mouth here—too much on the paper exercise of trying to create an entity in the Government and a comprehensive policy and more of what is necessary, what you heard in the preceding panel, of really getting on with the business of actually solving some very real problems.

Mr. GLICKMAN. Let me ask you this.

There has been a lot of polarization in the last couple of years—actually, the last 5 or 10 years, it didn't just all start with James Watt, although clearly it has been enhanced by weighing and balancing the needs here. Has the environmental community had much of a dialog with mining interests, basically industry, which you might consider to represent an attempt at reconciling divergent views of both groups regarding minerals exploration.

I think that there has been dialog between the two. You talk about some of the R&D aspects, surveying techniques, satellites and——

Ms. BABCOCK. Right.

Mr. GLICKMAN. I feel we ought to try and work toward some sort of reasonable consensus on some of these substantive issues, because they are all not black and white. I am wondering, you are, in a sense, representing the environmental community here, I thought you might want to comment on that.

Ms. BABCOCK. Sure, I would be delighted to.

First of all, we are always interested in a dialog. Sometimes it is a little bit like trying to arrange a marriage or a courtship, I mean, who is going to take the first step? I think there has been hesitancy because of the politicization of this issue, to have either side come forward and offer the bouquet of roses to sit down and talk, and I would certainly be happy to initiate such a dialog or suggest that perhaps your staff would like to perform a function of getting us together around a table to just listen to us talk.

I think you are right, the differences are not that extreme. In my testimony, what I try to do is to narrow down the areas of concern. That we are not talking all wilderness, all public lands, we are

talking about lands that are identified for their particular unique characteristics.

And even there, I think we are willing to concede that if there is a serious conflict, and indeed the statutory structure is such, that if there is a serious conflict with a significant minerals deposit there, then clearly there has to be a reconciliation, and one of the forms of reconciliation is to allow the development to go forward, at least the exploration work, but also within the framework of environmental——

Mr. GLICKMAN. Right. I think that is a reasonable statement. Obviously, in certain circumstances, the burden is on the fact that forest management or water resources, or environmental concerns should take precedence, because of preserving resources in perpetuity. You may have a crisis or a serious problem in minerals-related issue that can be dealt with by doing the R&D and finding a substitute within 6 months. What I have seen on both the environmental side as well as the industry, is what you call the knee-jerk polarization. Everybody tends to go to this side, and tend to find that that is not altogether productive. I think that the dialog can and should continue, the rule of reason can usually work out responsible solutions.

For example, yesterday—I don't know if you were here, but the industry was showing slides concerning how they can fix problems up after they start work in the area. I would not buy everything they said just on the basis of six slides, because there may be other places where it hasn't been done. Obviously, you have become somewhat successful, as well as the American people, in convincing industry that unless they do their work compatible with the environment, it will be unacceptable.

Ms. BABCOCK. Right. That is a necessary step. One of the things that I would certainly be encouraged if industry would join with us in discussing ways that we could develop, either through amendments to the Mining Law of 1872, which I understand wave a rather large flag, or looking at the existing statutory mechanisms, regulatory programs, which would focus on those aspects, the development activities, the exploration activities which are not now regulated, that there are no standards for reclamation of a hard rock mining site.

Now, there is authority under Title VII of the Surface Mining Act to come forward with reclamation standards, and I believe that by the end of the previous administration, the report had come out making certain recommendations as to what those standards might look like or a process for developing those standards.

I think that would go a long way toward easing, at least, our concern and allowing activities to go forward in areas that we consider to be of high value from an environmental standpoint.

Mr. GLICKMAN. Mr. McCandless?

Mr. MCCANDLESS. I believe, Mr. Chairman, that you covered the areas of my concern well, and Ms. Babcock's responses. The only comment I have, Ms. Babcock, is that we get so taken up with the idea that these wilderness areas ought to remain wilderness areas, that we do not realize and take advantage of their potential resources, mineral resources, in the best of interest of the Nation.

In testimony on the previous day, witnesses talked about the importation of chromium, yet we have plenty of chromium available in the United States, the only reason we import it is because it is less expensive.

Given certain sets of circumstances in South Africa or other areas, we would have to go into the domestic chromium mining business. And I would hope that the dialog that I heard between you and the chairman would accept those kinds of requirements in the national interest.

Ms. BABCOCK. Sure. I think there is always a danger of when you start defining what are the circumstances which justifies taking that step. But as long as there is an appreciation of the nonmaterial value of those lands, that they offer something of great worth to be balanced against, development of the underlying resource, Congress certainly has within its authority in any point in time to simply release lands which have been withdrawn in the event of a national emergency or some less order—event of less severity.

But I would think—I would certainly hope that from the environmental community would get a responsible response if that event did happen.

Mr. MCCANDLESS. Thank you, Mr. Chairman.

Mr. GLICKMAN. Thank you for coming here and testifying. We appreciate your testimony.

Ms. BABCOCK. Thank you for accommodating me.

Mr. GLICKMAN. This concludes this series of hearings on materials policy. We will have a fourth day some time in the near future where we will have industry and labor representatives who will come here and talk about that issue.

[Whereupon, at 11:30 a.m., the subcommittee was adjourned.]

MATERIALS RESEARCH AND DEVELOPMENT POLICY

FRIDAY, JUNE 24, 1983

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:10 a.m., in room 2318, Rayburn House Office Building, Hon. Dan Glickman (chairman of the subcommittee) presiding.

Mr. GLICKMAN. The Subcommittee on Transportation, Aviation and Materials of the Science and Technology Committee will please come to order.

Good morning, this subcommittee meets for the fourth and last day of hearings on critical materials and relevant Federal policies relating to those materials. Today we will focus on primarily the industrial and labor views of problems and concerns in the materials sector of the economy.

Of real concern to me and others looking at this issue is our Nation's ability to compete here and abroad. Developments in our basic materials industry have far-reaching effects on entire industrial sectors, including automotive, aerospace, communications, and computers.

Recent reports for instance, show the steel industry operating at less than 40 percent capacity with over 150,000 steelworkers unemployed, many of whom will remain that way even if the economy improves substantially. At the same time, steel imports have more than doubled since the 1960's—to 22 percent—and are expected to increase even further to almost 40 percent by 1990.

In the transportation field the Japanese and Europeans are focusing on materials development of a new ceramic engine—a development that will revolutionize the automotive industry. Finally, we are apparently locked into a protracted struggle internationally to determine which country will dominate the market for the new fifth generation of computers—a determination heavily dependent on advanced materials technological developments.

These and other examples, I believe, argue forcefully for establishing improved strategies dealing with this Nation's critical materials problems. Such strategies, hopefully, to include joint collaborative efforts by the Federal and private sectors.

In closing I would just reemphasize that it is these critical materials and related technologies that have put us in space and that have given us a technological and economic edge. Without these we

face problems every bit as grave as those we see in the energy area.

I believe our witnesses today will address these and other concerns in their testimony. I am looking forward to hearing those views.

Our first witness today is retired Adm. Bobby Inman, former Deputy Director of the CIA and now head of MCC Corp. a new consortium of computer companies doing research aimed at keeping the United States ahead of foreign competition in the computer field.

Admiral Inman, it is a pleasure to have you here today. You have distinguished your country in so many ways and now you are working to keep us ahead technologically and economically. We are delighted to have you as a witness today.

You may proceed as you wish.

I would say, also, that our ranking minority member, Bill Carney, was unable to be here and his statement will be included in the record at this point.

[The opening statement of Mr. Carney follows:]

OPENING STATEMENT
HONORABLE WILLIAM CARNEY
JUNE 24, 1983
MATERIALS R&D POLICY

THANK YOU, MR. CHAIRMAN. I JOIN WITH YOU IN WELCOMING OUR DISTINGUISHED WITNESSES TO THE SUBCOMMITTEE TODAY. I LOOK FORWARD TO THEIR TESTIMONY, PARTICULARLY IN REGARD TO THE EFFECTIVENESS AND IMPLEMENTATION OF THE 1980 MATERIALS POLICY ACT.

WE HAVE PREVIOUSLY HEARD THREE DAYS OF TESTIMONY FROM A VARIETY OF WITNESSES DISCUSSING ALL ASPECTS OF P.L. 96-479. THIS LAST DAY OF HEARINGS WILL NEATLY WRAP UP THESE DISCUSSIONS SINCE WE WILL NOW HEAR FROM INDUSTRY AND LABOR REPRESENTATIVES.

ALL TOO OFTEN WE ARE QUICK TO CRITICIZE THE ADMINISTRATION FOR ITS POLICIES REGARDING LONG TERM RESEARCH AND DEVELOPMENT. I HAVE HEARD ON A NUMBER OF OCCASIONS, AND NOT JUST ON THIS COMMITTEE, MEMBERS OF CONGRESS ASKING INDUSTRY AND FEDERAL AGENCIES IF THEY CAN USE MORE MONEY FOR RESEARCH AND DEVELOPMENT. THESE PEOPLE WOULD BE HARD PUT TO SAY NO.

IT IS THE INTENTION OF THIS ADMINISTRATION TO REESTABLISH AN APPROPRIATE ROLE FOR GOVERNMENT; NAMELY, FEDERAL AGENCIES SHOULD BE INVOLVED IN LONG TERM, HIGH RISK RESEARCH AND DEVELOPMENT, AND INDUSTRY SHOULD CARRY THE FRUITS OF THESE R&D EFFORTS INTO THE MARKETPLACE.

THIS IS TRUE FOR THE AEROSPACE AND AUTOMOTIVE INDUSTRIES, AS WELL AS FOR OUR MATERIALS EFFORTS. FROM THE PREVIOUS THREE DAYS OF TESTIMONY REGARDING MATERIALS R&D, WE ARE ALL FAMILIAR WITH THE POTENTIAL FAR-REACHING EFFECTS THAT AN AGGRESSIVE MATERIALS INDUSTRY WILL HAVE ON A NUMBER OF OUR INDUSTRIES. I AGREE WITH YOU, MR. CHAIRMAN, THAT WE MUST IMPLEMENT IMPROVED STRATEGIES IN DEALING WITH THIS NATION'S EMERGING MATERIALS INDUSTRIES. AND MOST IMPORTANTLY, THESE STRATEGIES MUST INCLUDE JOINT COOPERATIVE EFFORTS BETWEEN GOVERNMENT AND INDUSTRY.

THANK YOU, MR. CHAIRMAN.

STATEMENT OF ADM. B. R. INMAN, RET., PRESIDENT AND CHIEF EXECUTIVE OFFICER, MCC CORP.

Admiral INMAN. Mr. Chairman, it is a privilege and honor to appear before the committee this morning. I have been invited several times over the past year to appear before congressional committees but I have usually been traveling or declined. I consider the nature of the subject you are addressing of sufficient importance that I came back late last night in order to appear.

I don't have a formal statement but I will go through some thoughts that I put down as I traveled that I hope will be relevant to what you are trying to accomplish. This is, in fact, my first appearance back on the Hill since I retired. I am still wearing a dark blue suit but there is no gold in the sleeves and there is some color in the tie in this case.

The topic we are dealing with is a serious one indeed.

As a country we need to stand back and focus on the fact that the nature of the business of trade and commerce as we knew it has changed dramatically and will never go back to the way it used to be. In 1960 there was no major segment of U.S. industry that had more than 10 percent of its business impacted by international trade. By 1980 a large number of sectors have at least 25 percent, some as much as 50 percent, and that is the world we will have to live with and adjust to as a country.

We have all the opportunities that offers as well as the worries. The worries are that if we get into trade wars because we have been lackadaisical about staying in this international trade business we will run the high risk of breaking up alliances and opening opportunities for activities that could be disastrous for us from our principal adversaries.

If on the other hand we recognize the challenge to get on in our own unique way to keep the lead of technology around the world, then we ought to comfortably be able to deal not only with keeping alliances together but in fact taking advantage of the opportunities for a booming economy at least through the rest of this century.

But it will not happen by accident. It will only happen if we focus on a wide range of problems.

I am certainly not expert to deal with the materials area. But let me try to deal with a user of what that will produce and to help you understand critically important industries to this country's economy and one in particular that will boom in the world whether we lead it or whether we follow: The information handling business, of which I am now trying to put together an effort to help keep us in the lead technologically.

In 1981, it generated worldwide revenues of about $325 billion. The United States had about $136 billion of that trade. Every estimate I can find projects a growth rate in this industry, compounded growth rate, of 15 percent. That says for the world this is a $1 trillion annual revenue market by 1990.

In the United States itself at the rate of growth if we are even reasonably forthcoming, if we don't lose our share of that market, that ought to be a $500 billion industry by 1992.

Right now there are 5 million people around the world employed in this information handling industry, 2 million of those in the United States Two point eight percent of the GNP in 1981, as much as 6 or 6.5 by 1992 will be involved here. We can have a commanding share of that marketplace for all the advantages that it offers in the United States, not only in national security but in jobs for people, if we in fact provide the leadership.

What is the nature of the competition? First, it is worldwide. If one simply looks at the facts, our friends in Europe have recovered in their economies from the impact of recessions—they are feeling the current one perhaps a little harder than we are—but they basically are growing at about the same rate and they are organizing nationally and internationally to stay at the forefront of technology to try to lead the competition, to accelerate their growth in the 15 years out ahead.

If one examines such efforts as the European Common Market program called ESPIRIT to design the next generation of computers and to do substantial work in computer manufacturing, it is an attractive program as laid out with a promise of their being competitive in the international marketplace.

When one looks at Japan, indeed the facts inform us that their growth rate exceeds ours substantially and that that is likely to continue. The Japanese have a different model, different from even the European, certainly substantially different from ours.

They have effectively used government financing—government directed efforts—in the research area to gain the technological lead and then to encourage, facilitate trade, capturing major segments of the market. That direct investment was telegraphed to the world in 1974 when they put together under the Japanese Ministry of International Trade and Industry, an investment program that rough equivalent of $250 million, and people from a number of Japanese competing corporations. Four years later that effort produced the random access memory chip, new production techniques, and captured a substantial share of the international marketplace including substantial shares of the U.S. market.

Two years ago they announced their plans for a program twice the size of the original semiconductor effort to design the next generation of computers, entitled the "Fifth Generation Computer Program."

The combination of government funding and talent drawn from businesses offers a prospect of accelerating the Japanese competitive potential in this worldwide information handling business. We neglect that at our own substantial economic peril and potentially national security peril if we cannot stay at the lead in technology.

What are the resources available to the United States to in fact keep us in the commanding economic position we must be in? You have to look at what we have done over the postwar years. We came out of World War II not only as the strongest military power in the world but with the strongest functioning economy and we were generous beyond any parallel in history in helping both friends and foes recover.

But we also did some other things in that process that fueled our own growth, investment in education, and investment in research and development.

The great thrust in education came from the GI bill, but often neglected was the paralleling enormous contribution of direct grants for graduate studies largely flowing out of the Department of Defense.

If you go to a number of the most enlightened U.S. corporations today, particularly in the technology field, you will find if not at the CEO level—often there but certainly in other senior positions—individuals who got doctorates in the sciences in the late 1940's and 1950's on grants from the Office of Naval Research and their companion defense organizations, because we had a view at that time that investment in basic research and investment in graduate education had the long-term potential not only for commercialization but of producing things of great value to Defense.

In the 1960's as we became fascinated by new approaches, the question of Defense expenditures became "is it cost-effective." One of the early casualties of the 1964-65 timeframe was much of that investment in basic research and particularly in grants for graduate education that didn't have strings attached. Suddenly Government—Defense—only made those investments if one could directly tie them to a future weapons systems development. If you simply examine the charts, those decisions made in 1964-65 by 1968 were beginning to have their impact and the decline in the number of U.S. graduate students in the sciences and in mathematics began to be apparent from that timeframe on.

The enrollment in graduate schools did not drop appreciably because foreign students came, in recognizing the quality of U.S. graduate eduation, and took up the slack. But our own potential nucleus of talent to keep us at that forefront of technology and economic advantage began to erode from those basic decisions.

I now have a consortium put together by 12 companies and we will soon announce a 13th member. The decision to create that consortium did not come easily for these companies because it is against the basic cultural business approach to keep from your competitor what you have done in R&D until you can get to the marketplace first.

Why did they gather? The Japanese inspiration played a major role. But beyond that is a recognition that we no longer are producing the numbers of graduate computer scientists and electrical engineers that we can afford to let a large number of companies inde-

pendently recreate the same basic technologies. If we cannot find the mechanisms to focus the talent we are producing on areas that offer the prospect of substantial success, we will not be competitive at the international marketplace no matter what other steps we take.

I believe this example now being followed in the area of computer and microelectronics technology has direct applicability in the materials area as well. In fact we will be dependent on the materials area to be sure we can capitalize in our own future technological accomplishments in the areas of advanced computer design, computer software technology, computer aided design and manufacturing.

If you would forgive me for volunteering thoughts on what we might do about it, we don't want to recreate the Japanese model. We do things differently in this country. But we have demonstrated that if we put our minds to it we can use our unique system to be very competitive.

The first thing we need to do is encourage joint research and development activities. We cannot afford to waste the pool of talent that we have. That says we will have to revisit antitrust laws, but we don't want to throw out the baby with the bathwater. We need to keep competition at the marketplace but we have to recognize there is an international marketplace now, not just a domestic one, and that we must have the mechanisms to bring together talent insuring that the fruits of that effort, the technology developed, will be available in reasonably short time to U.S. companies that have the potential for producing it and keeping us competitive in the world.

To further encourage that investment in R&D not only in this industry but in others, we need to address the tax questions. We need to make the current R&D tax credit permanent, we need to expand its application. I signed on as the chairman, president, and chief executive officer of MCC on January 21, 1983. I hope it is totally coincidental that on that day the Internal Revenue Service issued a draft regulation that would decree that software development is not a research or experimental expenditure and therefore does not qualify for tax credits.

Mr. Chairman, as one who managed very large U.S. investments—I spent a lot of us taxpayers' money over 10 years in buying lead state of the art, surveillance systems, processing systems, computer systems—in almost every case the most demanding area for success, the area of the largest cost overruns, was in software development. And to decree that software expenditures should not qualify for the R&D tax credits is to me absolutely ludicrous.

We need to accelerate depreciation treatment of equipment in high-tech areas and where there is a high risk and I believe in encouraging companies to get on with investment in the materials area, to move off of just achieving profits off what we have done in the past and to get out there and see what one can achieve in new materials areas; that one should look for accelerated depreciation potential as one means in which government can accelerate that investment.

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Where government investment is concerned, it probably will not surprise you that I am reluctant to encourage major direct investment. I think we ought to let business create the climate where they will work, but encourage them to do it. There may be occasions where the risk is high, where national security needs might be likely, where there would be novel architecture or components. In that case we should take the approach of government investment in a mechanism where we are certain that it would involve both universities and business as partners in the process.

Finally, we cannot neglect the area of human resources in education. I believe we are already critically deficient in producing the number of graduate students, graduate scientists in computer science and engineering, in manufacturing systems engineering, in applied materials science, in magnetic storage technology. There may well be other areas but those are directly relevant to the success of my own effort and others I hope to come along after it.

We are going to have to find a means to encourage further expansion of education in those areas, whether it is done by Federal investment, by State or local investment, or simply by partnership that encourages the private sector again through potential tax credits, to invest in grants for education. We have to get on with the program that assures that we build as we did in the 1940's and 1950's. But to have the graduate students is necessary, and we have to pay attention to public education all the way from kindergarten through the 12th grade and the emphasis, sadly, as I emphasize even with my own sons, has to be not on whether they are going to be happy and enjoy what they are doing, but on whether they are going to get the basic grounding in mathematics and science that will permit them to have the opportunity to contribute to the technological development of this country in the decades out ahead.

One can approach the next 15 years with gloom if one only looks at the challenge, but if one also looks at the opportunities and the potential for an enormous booming economy and jobs, there is great reason for optimism if we only harness our efforts.

That concludes my remarks, Mr. Chairman.

Mr. GLICKMAN. Thank you.

First of all I wonder if you might tell us a little about your consortium; is it a profitmaking entity?

Admiral INMAN. In 1982 following watching the Japanese activity, particularly the decision to invest in the fifth generation computer design, Mr. William Norris of Control Data Corp. moved from expressing concern—he had been expressing concern since the first effort by the Japanese in semiconductors—moved to action. He succeeded in getting senior executives from 15 other major corporations to join him in Orlando, Fla. in February 1982. It was very diverse group of executives, but one thing they had in common was they all had their lawyers with them, concerned about the implications of antitrust. Out of that meeting they decided they could not wait for government leadership, that they would meet the challenge as a private sector endeavor, that they would put together a potentially for-profit concern—it is going to be a long time before it shows a profit—but they agreed to set up a corporation and to define the research that would be undertaken.

Micro Electronics Computer Corp. was chartered in Delaware in August 1982. The bylaws provide that a corporation can become a member, but it is limited to U.S. corporations; that that U.S. corporation can become a member with a relatively small investment of capital, but that that corporation must be prepared to do two things: they must support an area of research for a minimum of 3 years, and they must provide talent to this research pool.

We are not open for venture capital investment. Companies that are going to be part of it must have talent to pool as well as the money to support it.

The separate effort defined four areas of research that will fill our time at least in the early years. There is a 6-year program for packaging integrated circuits, taking what we know and using technology to create packaged chips in a shorter period of time and examine new substrate materials to be used for production techniques. It will try to use tape automated bonding production techniques to produce much higher quality and much higher quantity. There is also now an advanced research element looking for what kind of techniques beyond tape automated bonding ought to be approached.

The 7-year program is computer software technology looking not only at how you find productivity improvements but basically can we find new approaches for engineering software that insure much quicker production at very substantially reduced cost.

The third area, an 8-year program, is computer-aided design, computer-aided manufacturing. It reads like most of the other Cadcam programs underway. In this case there are advantages, there are nine of the shareholders that are members, and we may be able to pull together a quality data base and working tools to access it that will push the state of the art in Cadcam along at a faster rate.

The 10-year program, the largest one, is advanced computer design. There are four basic elements, artificial intelligence or knowledge-based systems; data base management; human interface; and parallel processing. We hope at the end of 3 years in that program to be able to apply the results of oncoming VLSI technology and we will not approach actually trying to design prototype systems probably until 6 or 6.5 years out.

If one of the shareholding companies invests in research to support one of these four programs, out of it they get 3 years lead in being licensed to go to the marketplace in competition with the other investors in that program. All intellectual property, all patents become the property of MCC. After 3 years any corporation may be licensed for production. There is no advantage to a shareholder who did not invest over an outside smaller company or larger company in being able to be licensed.

Part of the revenues from the licensing process are retained by MCC. That is our long-term prospect for profit and ability to reward with cash grants those who contributed the intellectual accomplishments. But it is also the means by which those who invested in R&D hopefully will get back over the long-term some of their own sunk R&D costs.

Mr. GLICKMAN. This is a fascinating concept. It must be a very dramatic event in the corporate world to see something like this happen. Has it ever happened before?

Admiral INMAN. This is a unique one, Mr. Chairman. There was a consortium created in the power industry, the Electric Power Research Institute, about 8 years ago, based in Atlanta. The utility corporations contributed money and this one organization focused where the research would be placed.

The Semiconductor Research Cooperative, formed 2 years ago by a substantial number of firms in the semiconductor business, is essentially patterned after the earlier EPRI effort. We are unique and different because the research will be done in-house rather than being farmed out elsewhere.

It was not an easy decision for these corporations to undertake. I examined a number of other business opportunities, in fact was very close to signing on on an entirely different activity when I was approached to undertake this one. As I went to talk to my friends in the business world to describe this new approach that struck me as being fascinating, I would barely mention that there was a joint venture until they put up their hand and said, oh, be careful, joint ventures tend not to work well. Then I would go on to describe it and its uniqueness and in almost every case they would respond that it is absolutely unique, and if it works it will be a great thing for the country and the industry.

But time and again it was, if it works.

Ultimately that became a challenge in its own right and it was too exciting to pass by.

Mr. GLICKMAN. Have you successfully resolved the antitrust problems in this endeavor?

Admiral INMAN. We are very comfortable, both the shareholders and B. R. Inman, who is the CGO, and who is the only employee at this point, that we are within the letter of the antitrust laws. But that doesn't protect us from the prospect of being faced with private sector treble damage lawsuits. Indeed there is a firm on the west coast that made a good deal of money out of these kinds of suits, including the National Football League of late, that is looking for a client, we are told, to file a suit here.

We are comfortable that we would win any such suit but the legal fees over 5 years would be enormous. As I traveled around the country talking to companies that had expressed interest in MCC but decided not to join, I found that for at least one small company, the ambiguity in antitrust laws, the worry about the legal fees compiled over a long period of defending against private treble damage lawsuits placed on top of R&D investments in a time of recession simply, was more than they were willing to undertake.

So, no, the ambiguities are not resolved. There are a number of bills on the Hill here—I hope we will get on with addressing them in this session because while these countries moved—these companies moved, they moved because the Japanese fifth generation program was public and announced and you don't have that same visibility for the efforts in the materials area, and other areas across other industries.

It was indeed reticence about the liability on the antitrust side I believe more than the cultural attitude about cooperation with

competitors that delayed as long as it did creation of something like MCC.

I believe clarification of the antitrust laws would be a very big boost about producing similar collaborative efforts in other areas.

Mr. GLICKMAN. I happen to be fortunate to serve on the House Judiciary Committee and I would like, I don't want to pursue this any further now but I would like at some point to bring you together with key staff and members of the Monopolies and Antitrust Subcommittee and perhaps the chairman himself to talk about this matter.

Admiral INMAN. Thank you, Mr. Chairman. I look forward to that.

Mr. GLICKMAN. Let me ask you a couple other questions.

You talked about the Department of Defense back in the forties doing a lot of basic research, and degree granting that was unrelated to mission orientation.

Admiral INMAN. Yes, sir.

Mr. GLICKMAN. You indicated that in the late sixties all of this, and in the seventies and eighties, under the Mansfield amendment had to be related to missions of weapons systems. With the Defense budget rising relatively rapidly now, with R&D budgets in other agencies of Government falling—with some exceptions, of course—I am seeing more and more R&D activities funneling their way into the Defense Department, the energy R&D, even materials R&D. I wonder whether you think that the Department of Defense is in fact veering away from this mission-related activity or not, and whether it should be veering away in this era of very large Defense spending?

Admiral INMAN. The Defense Department to my understanding is not veering away from the current restrictions both from its internal evaluation—when you get to the program evaluation and from the constraints in the law that were enacted following the lead which came from Defense about not investing—but I believe as a country we need to turn to different directions.

Mr. Chairman, there is a far better witness if this committee would like to pursue this topic that I would refer you to, and he is the source of my focus on this problem. Dr. George Kosmetsk is a very interesting individual. He was one of the founders of Teledyne. He decided he would rather teach than be an industrialist. He went to the University of Texas and built their business school into a world class institution, generally recognized to be one of the 10 best in the country. But he had very substantial personal income from his earlier Teledyne effort and he decided to devote his efforts to privately encouraging the critical operation of moving basic research to technology and commercializing that technology.

He is resident in Austin, still has association with the university, but he has done a lot of first rate academic work in charting the earlier investments, the cutoff of those investments and the impact. He has a number of solutions that he would propose.

In essence the last thing we want is the Federal Government trying to direct the research in this area. In the unique American system, where it was productive was where a large department with substantial resources was permitted to apply a very small portion of that toward investment in the future, investment in basic

research, and investment in grants for priority students that might potentially impact on the United States. What Dr. Kosmetsk's study would document for you is that it accomplished both goals for this country, it did indeed produce products in areas of research that the military found they would need and did use, but it also made major contributions to the commercial success of this country.

Mr. GLICKMAN. I think that NASA's work in the aeronautics program is one of those things that contributed across the board.

Admiral INMAN. That is right.

And they also cut back in that late sixties timeframe. So you had the cutback in Defense investment in basic research, you also had cutback in the NASA investment. That dropped off jobs, of course, and indeed the absence of grants and the drop in jobs had the expected result of the drop in production of graduate students.

Mr. GLICKMAN. The point of my question is that with such a tremendous shift in Government funds in research from non-Defense to Defense and we see so much of it is mission oriented that we are not doing what you said we were doing back in the forties and fifties.

Admiral INMAN. I would like a little trickle down to basic research that is not directly mission related.

Mr. GLICKMAN. That is a deviation of the normal trickle down theory but I guess we can put that in the record.

Let me ask you two more questions if I might.

Several years ago the Federal Government embarked on a multi-agency, multi-million-dollar materials intensive program on micro-electronic and micro-fabrication technology. How effective has that program and related spinoffs been in meeting international competition in computer technology and other related fields?

Admiral INMAN. It is a little early yet to know how effective the programs will ultimately have been. They are VSIC and VLSI, they were the major areas. As one stands back and looks at academic research at Stanford, Carnegie-Mellon, MIT, they not only stand at the top in almost any ranking in this country but they do in the world. If you look at the number of foreign graduates who are eager to study there it underlines that point.

A great deal of the investment in building up those three universities came from investment from the National Science Foundation and from DARPA. We need to expand that. We need to create additional centers of academic excellence. MCC's going to Austin is in large measure related to their private sector investment in major efforts to take the University of Texas-Austin and Texas A&M University to world class status in micro-electronics. There are not many places here in this country where people are willing to pull out their checkbooks and write checks to make that investment.

So I think the Government will have to take the lead.

I am optimistic that we will get out of both of those major investments ultimately substantial gains not only in the Defense Department in miniaturization, and in permitting us to design weapons systems, surveillance systems, recognizance systems, things that keep the peace, not just fight, because of those investments, but I think the biggest gains for the country will ultimately come in commercialization and that there will be likely a very major out-

flow to benefit our ability to compete in the international marketplace from those two major areas.

Mr. GLICKMAN. Isn't it true that much of the R&D work for the fifth generation computer and artificial intelligence was completed years ago but was kept on the shelf until the Japanese took interest? What can we do to catch up?

Admiral INMAN. It is one of the discouraging sides, I guess of competition in marketplace that you can find a great many industries where unique new designs and ideas were offered from the research activities but they were not turned into commercial projects because the corporation that had the lead did not see the need to move.

They were making profits. It is essentially the syndrome of focusing on the quarterly profits as opposed to long-term investment.

This is an area again where I am certainly not an expert but where we do have a substantial different approach that leads to a structural problem of competition with the Japanese. We look at equity-to-debt ratios in U.S. corporations, intensely in investment, we keep a distance between the bankers and the corporations themselves, and that leads to constant focus on what the profit is going to be for the quarter, not the long-term investment.

In Japan they have an entirely different approach. They have a debt-equity ratio that would scare almost every investment analyst in this country to death, five times greater debt. But there is also a close monthly working relationship between the bank and the corporation there in looking at long-term investment. It is easier in that Japanese system to get long-term investment in R&D.

I am not encouraging that we go to the Japanese approach and move the debt-equity ratio up that way but I think some thoughtful efforts in tax incentives and depreciation acceleration can have a comparable effect without causing us to have to change the basic approach.

Mr. GLICKMAN. The Japanese banking community has not been making big loans to Third World countries that are marginal. Some of the banking interests in this country have made questionable practices with the oil and gas industry like Penn Square which don't seem to have the experience in that area that the Japanese have had.

Admiral INMAN. It is not only the commercial manufacturing sector that focuses on short-term profits, that is evident.

Mr. GLICKMAN. We thank you very much for coming here, Admiral. I am appreciative of your coming to testify. I do want to follow up on the Antitrust Judiciary Committee angle I mentioned to you before because having somebody like yourself talking with key members may be useful.

Is your office in the Washington area?

Admiral INMAN. Temporarily until the end of August I will have an office in the Rosslyn section of Arlington and then I will personally move my headquarters to Austin about September 1.

Mr. GLICKMAN. Perhaps in August we can work something out.

Admiral INMAN. Thank you very much.

Mr. GLICKMAN. Our next witness is a person who I consider was one of the most eloquent Members of the House and it is too bad he is not still here. He is my former colleague, Jim Santini of Nevada

who was the congressional expert on minerals and materials issues. We are delighted that you are here, Jim.

STATEMENT OF JAMES D. SANTINI OF JONES, JONES, BELL, CLOSE, AND BROWN

Mr. SANTINI. Thank you very much.

I am happy to be here again on one of our favorite causes. I am pleased to see that you are continuing the initiatives you launched in the last two Congresses.

You may represent one of a very few but distinguished Members of the House who continues to focus on this vital critical question that impacts our Nation's future: minerals and materials.

Because, Mr. Chairman, I have been recently destaffed, my enthusiasm about getting to you my written statement was undermined by my own inability to prepare it in time. But I will try, with leave of the Chair, to submit that written statement to you within the next 15 days.

Mr. GLICKMAN. Your statement can come whenever it is ready.

Mr. SANTINI. The question of minerals and materials that has been of such vital concern to you and this committee, is reenforced by the evidence and statistics of the impact on minerals and materials in 1982. The picture in 1982 was a grim reflection of the dismal state of our national economy. Raw, nonfuel mineral output was down 21 percent. Copper production was down over 30 percent. Fourteen of the Nation's 25 largest mines were shut down. The 10, 11, 12 percent national unemployment figures in the national arena reflected a sick economic patient. The 38-percent unemployment figure in the mining industry revealed a patient in need of intensive care unit attention.

Metallic mineral prices were at an all-time low. Operating costs increased. To all these grim statistics one must add the fact that the demand for minerals dropped drastically. Some of the leading minerals companies in the Nation are going down for the 10 count. For the most part, new investment is out of the question. Corporate managers are spending so much time trying to stay afloat they cannot consider buying a new rudder for the boat.

A substantial change is taking place within the corporate structure of our Nation's minerals industry. Merger after merger has gobbled up the independent U.S. identity of the Nation's mining companies. For example, Sohio-Great Britain purchased Kennicott; Fleur Corp. France purchased St. Joe Mining; Arco absorbed Anaconda. General Electric is selling most of Utah International to an Australian private firm. Our domestic mining companies through mergers, are phasing out of existence. Fortunately, in some cases, the acquiring companies have capital reserve to keep the mineral portion of that corporate structure alive.

Certainly the picture is changing and changing substantially.

There is another important change that is taking place on the national industrial materials and minerals front. Plant by plant, smelter by smelter, America is losing vital links in the minerals processing chain.

America has almost lost all of its ferro-chrome finished chrome production. Today Japan and West Germany are the United States'

principal suppliers of finished chrome. We saw, in 1979, St. Joe's Mineral close the Nation's largest lead-zinc smelters in Pennsylvania. It has since reopened, but not at the same level of production.

In 1980, Anaconda closed its refinery and smelter in Butte, Mont. The result: The Nation lost 10 percent of its refining and smelting capacity and 5,000 men and women lost their jobs.

It is interesting as an aside, Mr. Chairman, to realize that 13 years ago, in the United States of America, Anaconda was the Nation's leading copper producer. This last month, Anaconda Copper Corp. did not produce 1 pound of copper.

The smelter dominoes continue to fall. In 1981, Gulf resources shut down its Bunker Hill lead-zinc-silver complex in Idaho. Directly, 2,100 workers were thrown out; indirectly 5,000 jobs were impacted adversely. That was the second largest smelting refining facility of its kind in the United States of America. In 1981, Phelps Dodge shut down or cut back all of its Arizona and New Mexico processing operations, forcing in that year 5,000 copper workers out of jobs. They have reactivated and are hoping to realize their former level of production by 1984.

With our declining domestic production of minerals comes an inevitable consequence of our foreign dependence on either minerals or processing. What is the story behind these numbers? In the instance, for example, of Anaconda Copper, in Butte, Mont., the year after the closure of that smelting-refining facility, Anaconda's aggregate was loaded on trains in Montana, Utah, and Arizona. The trains went to San Diego; from there, the aggregate was loaded on a boat; the boat then went to Japan. The enterprising island of fifth generation computer research is also very enterprising in refining our own copper product and then turning around and selling it back to the American consumer.

It is just one illustration of a very serious problem facing this Nation both presently and in the future.

The General Accounting Office on April 19, 1979, released a report entitled "Looking Ahead: The Need for a National Minerals Policy and a Planning Process."

In that report, the General Accounting Office speculated on the possible significance of continued dependence or foreign sources for essential materials. They concluded that by the year 2000, in just economic terms, the balance of trade could reveal a $100 billion deficit.

The comptroller general, focusing on the problem, concluded that in the future, the United States must strike a better balance—and I quote—"between its materials problems and the pursuit of other important national goals."

In discussing the steps necessary, the GAO found,

> Even though minerals are central to America's industrial health and economic welfare, the Federal Government has never given materials availability the serious sustained attention that it deserves.

That is presumably an unbiased observation by an agency of government that is supposed to look at, examine, and produce conclusions with respect to failures of the National Government to respond to national urgencies or needs.

Mr. Chairman, I commend you again for your diligent pursuit of this very important and critical question. I am hopeful that the initiatives that you launched, both in these hearings and in previous Congresses, will produce some of the tangible changes that are imperative if our Nation is going to get its minerals act together.

I would be happy to respond to any questions.

Mr. GLICKMAN. Jim, what do you think we need to do in this country to address our minerals and materials policy questions—I mean legislatively? What specific steps do you think we ought to go take?

Mr. SANTINI. In the broader scope or scheme of things the legislation that you, Chairman Fuqua, presented to the House of Representatives in, I believe, October last year, in which you proposed the establishment of a materials and minerals council is, to my mind, an imperative, first legislative step before any of the spinoff improvements or corrections that are in the national interest can be made.

The present scheme of minerals decisionmaking is chaotic and tangential, or nonexistent. In that circumstance, it then is imperative, it seems to me, to have some entity functioning at a broad cabinet level position. This entity would bring together all of the elements of correction of this critical problem and take a look at the big picture, as you propose and as Admiral Inman so well articulated, and start to compose the various pieces of a policy cause and effect response plan.

Until that happens, we will continue to see this sort of indifference, apathy, and tangential kinds of responses instead of a cohesive well-managed directed plan or program. Until that time, you will get silly initiatives by the IRS to penalize corporate America for doing R&D. Until that time, you will find Americans floundering in research and development directions to respond to the constructive and awesome challenge of the Japanese.

Mr. GLICKMAN. You know, we passed this law in 1980, the National Materials and Minerals Policy, Research and Development Act that called on each of the agencies of Government to come up with basically what they have been doing, their assessments of needs and their plans for implementation. We had a hearing last month in which we found out that the only Department that had complied was the Commerce Department. Interior had not complied, Defense had not complied, and the Office of Science and Technology Policy had not complied. I mean they were a year late at least and only the one Department had complied with the law. It is curious, that it was the Department that was basically related to the commercial side of the picture which complied by doing case studies in a couple of industries on the critical relationship between minerals, materials, and policy.

My concern is that we at least at this stage of the game have a government that is not terribly interested in making this a priority issue at all. Where it is a priority issue it has become terribly politicized in the Department of the Interior, where it has been kind of melded with the personal problems that are associated with Jim Watt. I wonder if you might have any comments on that.

Mr. SANTINI. I think your Minerals and Materials Act is a good case study of the inability of our National Government to cope

with the legislative mandates and prescriptions of any kind of comprehensive, cohesive response to the problem. Your oversight hearings are a very constructive revelation in that regard. It is true that the present administration is perpetuating the sins and failures of past administrations. I think the failures are as much institutional and structural as they are related to the individual personalities concerned.

The Reagan administration, in its incipient postelection months, instituted a task force on minerals and materials to look at the question. That was an important first. We had never had a task force on the issue. Unfortunately, the task force initiatives simply were never translated through the institutions of government into a constructive positive response. Their failure to comply with the mandates of the Minerals and Materials Policy Act of 1980 is compounded in several other arenas, by various agencies of Government who are continuing the indifferent business as usual with regard to minerals and materials. It is bloody well exasperating, but you are correct. There is some modest improvement in some arenas in some agencies, but the overall problems are not being addressed.

Mr. GLICKMAN. How would you prioritize the minerals and materials problems? Let me give you a couple of things to consider: Overall coordination, materials R&D, public lands issues, trade and regulations, tax issues, stockpiling, and others. Is there any way to determine which are of higher importance and which are not?

Mr. SANTINI. Perhaps. I suppose one's priorities in this area would depend on one's focus or particular interest. It seems to me the point you have made and I have endeavored to make in the past about the need for putting a plan or program in place is No. 1. No. 2, establishing the council to help oversee and implement a policy plan or program. No. 3, getting a stockpile that in quality and quantity meets the Defense Production Act goals. No. 4, looking to research and development initiatives such as the ones enunciated by Admiral Inman this morning and echoed by some of your other witnesses in other hearings you have conducted. No. 5, recycling and looking at recycling to make a meaningful contribution, a percentage contribution to our horrendous foreign dependencies as indicated by my various charts and graphic examples. That would be an order in which I would put things as an attempt to fashion a redress to this very serious and substantial problem. Within that comes, then, the response of the public land issues, the trade regulations, the taxes. All of that should then start fitting in as a component part of an overall program or plan.

Mr. GLICKMAN. Maybe in your written statement you might want to amplify on this area a little bit. Let me just ask you a little more specific question. What are the economics of having U.S. copper ore sent to Japan for processing into copper? Why can we not meet our domestic needs with domestic production? Is the cause of the problem regulation, bad management, or what?

Mr. SANTINI. The causes of the copper industry's problems are compound. Certainly the state of our domestic economy is one of those causes. No. 2, foreign competition is essentially subsidized competition. The price of copper is determined by the international marketplace. You have copper producers in the world today who do

not respond to the ordinary buy/sell components of the marketplace. They continue to pour out a copper product at a less-than-profit price, because it represents a national jobs priority within those copper-producing nations. In a free-market society where you do not have direct government subsidy for your principal mineral-producing facilities, the producers are placed at a substantial competitive disadvantage, because the competition is not fair. No. 4, the regulations have had a part in adding to capital costs and therefore, in making copper production processing less profitable than before.

But again, we cannot begin to solve these problems until the Nation is willing to sit down and ask the very basic question you asked, "Do we want a domestic copper industry?" We have the resource in the ground, unlike manganese or chromium or nickel or vanadium. We have enough copper in our country to meet our domestic needs. But what we have done by our indifference and ambivalence in this Nation is succeed, for example in Anaconda's case, in shutting down a copper producer that was the leading producer in the Nation 13 years ago. Why? Because we have not determined whether or not it is a national interest to have a copper industry. Furthermore, once the decision is made, we must determine how we are going to sustain it in the context of these world and economic variables.

Mr. GLICKMAN. Thank you, Jim, for testifying today. As usual you are about the best witness that we ever get. We wish you were back here.

Mr. SANTINI. After I pay the grocery bills, Mr. Chairman, I may be back.

Mr. GLICKMAN. Do not move to Kansas is all I can tell you.

Mr. GLICKMAN. We have four more witnesses left, and I would like to take them in panels if possible. Is Dr. Tuesday here yet? Is Dr. Owczarski here? Is Mr. Marlowe here? Is Dr. Stanley here? Why do we not go ahead and take Dr. Owczarski and Dr. Stanley, you will still testify separately, but why don't you both come up here in a panel.

When Dr. Tuesday gets here, we will just have him join the panel. I now understand that Mr. Marlowe will not be here today as orignally scheduled.

Dr. Owczarski, it is a pleasure to have you here. We appreciate your interest in coming to talk about an issue which we believe is of high significance and importance for the American economy. All of the statements will appear in the record in their entirety. You may desire to summarize or proceed as you wish.

STATEMENTS OF DR. WILLIAM A. OWCZARSKI, CHAIRMAN, NON-FUEL MINERALS TASK FORCE, NATIONAL ASSOCIATION OF MANUFACTURERS; DR. TIMOTHY W. STANLEY, PRESIDENT, INTERNATIONAL ECONOMIC POLICY ASSOCIATION; AND DR. CHARLES S. TUESDAY, TECHNICAL DIRECTOR FOR CHEMICAL AND MATERIALS SCIENCES, GENERAL MOTORS TECHNICAL CENTER

Dr. OWCZARSKI. Thank you, Mr. Chairman. Although I am employed as a manager of technical planning of Pratt & Whitney

Group of United Technologies, I appear today as chairman of the nonfuel minerals task force of the National Association of Manufacturers. This task force was formed by the National Association of Manufacturers in 1980 because of the growing concern at NAM and by the representative members over materials and minerals issues. The task force consists of about 50 people representing companies who are both producers and users of strategic and critical materials and minerals.

As you know, there has not always been agreement on issues between suppliers and consumers, but we feel that our task force has been able to bring together people from both sides and been able to arrive at important and perhaps unique consensus in many of the areas that we will be discussing here today.

Your letter of invitation identified a number of areas of interest to your subcommittee, primarily of our views on Public Law 96-497, the National Materials and Minerals Policy, Research, and Development Act of 1980. In this law it is stated that, despite the enactment of the Mining and Materials Policy Act of 1970, the United States does not have a coherent national materials and minerals policy. Today, almost 3 years after the law has been passed, that statement still bears a lot of truth. There has been active and aggressive effort in the Department of Commerce through its Office of Strategic Resources and other activities in the Cabinet Council on Natural Resources and Environment, but there has not yet been much done to develop a comprehensive strategy for coming to grips with our materials and minerals needs.

The reason is identified in the President's April 1982 report to Congress. It says, "The involvement of numerous Federal agencies in the materials issue reflects both the breadth of the issue, not only in the government but in the economy, as well as the existence throughout Government of statutorily assigned missions and responsibilities which relate to materials policy." It is this diffusion of program responsibility and diversion of program responsibility which has hampered as much as anything the implementation of the 1980 statute.

The President has assigned the task of coordinating the national materials policy to the Cabinet council. This was in recognition that indeed the national policy was uncoordinated and in need of cohesion. Yet the Cabinet council has met only infrequently on materials issues and operates on an ad hoc basis without permanence or clearly defined lines of communication with the rest of Government. Of greater concern to us is that a future administration with different priorities or organizational preferences might abolish the Cabinet council and return materials policy to the ill-defined inactive status of the past.

By recent action of its board of directors NAM has recommended the creation by statute of an office or council of minerals and materials within the Executive Office of the President to insure that the goals of the 1970 and 1980 statutes are fulfilled and that important materials issues are considered on a timely and continuing basis. NAM believes that this organizational structure would be far more conducive to effective policy implementation than the present situation.

In the area of the national defense stockpile, as you know, authority over management of the national defense stockpile is very fragmented. Many agencies and Congress are involved in the approval of stockpile transactions. The General Services Administration handles all the buying, selling, shipment, and storage of stockpile materials, but the Federal Emergency Management Agency—FEMA—chairs interagency formulation of the annual materials plan. This materials plan provides the basis for FEMA's establishment of stockpile goals, priorities, and transaction decisions, subject to approval by the National Security Council. These are then subject to review and approval by the Office of Management and Budget. At the same time, budget requests of other agencies with AMP responsibilities are processed through four other divisions of OMB. In addition, Congress ultimately must authorize releases or acquisitions as part of the annual budget.

This complex process makes decisions and transactions difficult and time consuming. Sometimes it takes months to get approval, acquisitions from the stockpile often become poorly timed. A unified direct management approach would permit stockpile policy to be more responsive to market conditions. In addition, there is no linkage or communication to relate the day-to-day problems to a meaningful long-range policy.

There are also concerns about whether the correct quantities of materials are maintained in the stockpile. Stockpile goals have been changed over the last 35 years frequently and some materials have changed as many as a dozen times. The erratic changes have been disruptive to the market and costly to the taxpayer.

Because the President, OMB, and Congress all have direct influence over stockpile policy, it has been used to serve political ends. Current and previous administrations' actions, motivated by political or budgetary considerations, have caused damaging and unnecessary interference in commodity markets and have contributed to insufficiency of stockpile inventories.

We believe that there are two fundamental principles that should govern the national defense stockpile management: first, the stockpile should meet national defense needs only, not economic and budgetary purposes; and (2) the stockpile should be managed by a nonpolitical, independent body.

There are other problems associated with stockpile funding and with the quality and the form of the stockpile materials. These issues are treated more fully in our attached discussion paper.

Very briefly, to cover this subject, when materials in the stockpile are sold, the proceeds are placed in a separate Treasury fund and are available for the acquisition of needed materials, but subject to appropriation by Congress. Because of budgetary pressures, Congress and the President have recently been unwilling to use the transaction fund for stockpile purchases and important stockpile goals remain unmet.

NAM, therefore, supports purchases, sales, or barter of materials needed to meet stockpile goals. We also favor amending the Strategic and Critical Stockpiling Act to make stockpile transaction receipts available for purchases without appropriation by Congress.

There have been other questions raised about the quality and form of materials held in the stockpile. In his policy statement of April 1982 the President pledged to "establish a panel with appro-

priate private sector input to review the extent of material deficiencies and to recommend remedial action." FEMA has committed funds to start this project and is working with the National Academy of Sciences and the Federation of Materials Societies in this regard.

NAM is encouraged that the efforts to assess the quality and form of the stockpile have been initiated, utilizing substantial advice from the private sector, and hope that they will be vigorously pursued to completion.

In the area of research and development, NAM supports research and development activities to increase the use of domestic materials and define viable domestic alternatives to strategic materials which are presently imported. In general, R&D should be left to the funding of the private sector. But except for mission- or user-oriented Departments such as the Department of Defense, Government research and development activities should be limited to basic long-time scientific efforts as an augmentation to private investigation.

NAM recognizes that it is important to recycle materials and increase the efficient use of materials to minimize mineral dependence and supports efforts to encourage these practices.

The Federal lands total over 700 million acres and represent, as the President stated, "a vast, largely undeveloped storehouse of resources that are important to the nation's welfare." This storehouse, however, cannot be unlocked in a time of need instantly and its contents made immediately available. As this subcommittee knows, many years are required from the time of discovery to production of underlying mineral resources. You also know that world economic and political events do not always allow for this kind of planned and orderly reaction. If this Nation is to be able to respond to possible overseas actions that threaten our supplies of import-dependent materials, not only must the national defense stockpile meet its objectives, but also viable domestic deposits of materials and minerals must be identified and developed. NAM is in full agreement with the President's observation that:

> New mineral deposits will not be found unless the private sector looks for them. It is to the nation's advantage to encourage this search. Government has a responsibility as owner of most of our better mineral lands to minimize unnecessary restrictions that limit that search. Economic use of our natural resources allows decisions to be based on full information of all values that are involved. Preservation of wilderness areas, for example, is an important goal that must be balanced against others, such as national security.

NAM believes that for much of the Federal land that has been withdrawn from development, resource potential information was sketchy, obsolete or even nonexistent. We hope that Congress in considering future withdrawals will have complete and up-to-date information on which to make better decisions. What we do not know can and may very well hurt us in the future.

Mr. Chairman, in conclusion, I would like to express the appreciation of NAM for this opportunity to testify, and we will look forward to working with the subcommittee on these important issues. I will be pleased to answer any questions that you might have.

Mr. GLICKMAN. Thank you, Dr. Owczarski.

We will hold the questions until all of our witnesses testify.

[The prepared statement of Dr. Owczarski follows:]

National Association of Manufacturers

TESTIMONY OF

DR. WILLIAM OWCZARSKI

MANAGER, TECHNICAL PLANNING

PRATT AND WHITNEY AIRCRAFT GROUP

AND

CHAIRMAN

NON-FUEL MINERALS TASK FORCE

NATIONAL ASSOCIATION OF MANUFACTURERS

BEFORE HEARINGS OF THE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS

HOUSE SCIENCE AND TECHNOLOGY COMMITTEE

JUNE 24, 1983

1776 F Street, N.W. • Washington, D.C. 20006 • (202) 626-3700

TESTIMONY OF
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MANAGER, TECHNICAL PLANNING
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NON-FUEL MINERALS TASK FORCE
NATIONAL ASSOCIATION OF MANUFACTURERS
BEFORE HEARINGS OF THE
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
HOUSE SCIENCE AND TECHNOLOGY COMMITTEE
JUNE 24, 1983

Mr. Chairman, Members of the Subcommittee, I am Dr. William Owczarski, Manager, Technical Planning, Pratt and Whitney Aircraft Group. I am appearing today as Chairman of the Non-Fuel Minerals Task Force of the National Association of Manufacturers. The Task Force was formed by NAM in 1980 because of the growing concern over materials and minerals issues. The Task Force consists of about 50 people representing companies who are both producers and users of strategic and critical materials and minerals. As you know, there has not always been agreement on issues between suppliers and consumers of the commodities essential to our economy and national defense. But we feel that our Task Force has been able to arrive at an important and perhaps unique consensus on the areas that we will discuss further.

The National Materials Policy

In your letter of invitation to testify, you identified several areas of interest to your subcommittee. Of primary importance to the subcommittee is our views of P.L. 96-479, "The

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National Materials and Minerals Policy, Research and Development Act of 1980." Section 2 (a)(7) of the law states that despite the enactment of the Mining and Minerals Policy Act of 1970, "the United States does not have a coherent national materials and minerals policy." Today, nearly three years after the law was passed, that statement still bears a heavy element of truth. Except for the active and aggressive efforts of the Department of Commerce and its Office of Strategic Resources, and the activities of the Cabinet Council on Natural Resources and Environment (CCNRE), there has yet to be developed a comprehensive strategy for coming to grips with our minerals and materials needs. The reason is identified in the President's April 1982 report to Congress: "The involvement of numerous Federal agencies in the materials issue reflects both the breadth of the issue, not only in the government but in the economy, as well as the existence throughout government of statutorily assigned missions and responsibilities which relate to materials policy." It is this diffusion of program responsibility which has hampered the implementation of the 1980 statute.

The President has assigned the task of coordinating the National Materials policy to the CCNRE. This was in recognition that, indeed, national policy was uncoordinated and in need of cohesion. Yet, the CCNRE has met only infrequently on materials issues, and it operates on an ad hoc basis without permanence or clearly defined lines of communication with the rest of government. Of greater concern to NAM is that a future administration, with differing priorities and organizational

preferences, might abolish Cabinet Councils, returning materials and minerals policy to its ill-defined status of the past.

By recent action of its Board of Directors, NAM has recommended the creation by statute of an office or council of minerals and materials within the Executive Office of the President to ensure that the goals of the 1970 and 1980 statutes are fulfilled and that important materials issues are considered on a timely and continuing basis. NAM believes that this organizational structure would be far more conducive to effective policy implementation than the present situation.

The National Defense Stockpile

As you know, authority over and management of the National Defense Stockpile is fragmented. Several agencies and Congress are involved in the approval of the stockpile transactions.

The General Services Administration handles all of the buying, selling, shipment and storage of stockpile materials, but the Federal Emergency Management Agency chairs interagency formulation of the Annual Materials Plan (AMP). The AMP provides the basis for FEMA's establishment of stockpile goals, priorities and transaction-decisions, subject to approval by the National Security Council. These then are subject to review and approval by the Office of Management and Budget. At the same time, budget requests of other major agencies with AMP responsibilities are processed through four other divisions of OMB. In addition, Congress ultimately must authorize releases or acquisitions as part of the annual budget.

This complex organizational structure makes stockpile transactions difficult and time-consuming. Because it takes months to get approval from the Executive Office and Congress, acquisitions and releases are often poorly timed. A unified, direct management approach would permit stockpile policy to be more responsive to market conditions. In addition, there is no linkage or communication to relate day-to-day problems to a meaningful long-range policy.

There are also doubts about whether the correct quantities of materials are maintained in the stockpile. Stockpile goals have been changed frequently in the past. Over the past 35 years, the targets of some materials have been changed as many as ten or 15 times. Erratic changes in stockpile goals and inventories have been disruptive for both producers and users, and costly to the taxpayer.

Because the President, OMB and Congress all have direct influence over stockpile policy, the stockpile has been used to serve political ends. Current and previous administrations' actions, motivated by political or budgetary considerations, have caused damaging and unnecessary interference in commodity markets, and contributed to the insufficiency of stockpile inventories.

We believe that two fundamental principles should govern national defense stockpile management: (1) the stockpile should meet national defense needs only, not economic and budgetary purposes; and (2) the stockpile should be managed by a nonpolitical, independent body.

There are other problems associated with stockpile funding and with the quality and form of stockpile materials. These issues are treated more fully in the attached discussion paper.

Briefly, when materials in the stockpile are sold, the proceeds are placed in a separate Treasury fund and are available for the acquisition of needed materials, subject to appropriations by Congress. Because of budgetary pressures, Congress and the President have been unwilling to use the transaction fund for stockpile purchases and important stockpile goals are unmet.

NAM, therefore, supports purchases, sales or barter of materials needed to meet stockpile goals. We also favor amending the Strategic and Critical Materials Stockpiling Act to make stockpile transaction receipts available for purchases without appropriation by Congress.

Questions about the quality and form of materials held in the stockpile have raised enough doubts that the President, in his April 1982 policy statement, pledged to "establish a panel, with appropriate private sector input, to review the extent of material deficiencies and to recommend remedial action." The Federal Emergency Management Agency has committed funds to start this action, and is working with the National Academy of Sciences and the Federation of Materials Societies in this regard.

NAM is encouraged that the efforts to assess the quality and form of the stockpile have been initiated, utilizing substantial advice from the private sector, and hope that they will be vigorously pursued to completion.

The Resource Potential of Public Lands

Federal lands total over 700 million acres and represent, as the President stated, "a vast, largely undeveloped storehouse of resources that are important to the nation's welfare." This storehouse, however, cannot be simply unlocked in a time of need and its contents made immediately available. As this subcommittee knows, many years elapse from time of discovery to time of production of underlying mineral resources. As you also know, world economic and political events do not always allow for well-planned and orderly reactions. If this nation is to be able to respond to overseas actions that threaten our supplies of import-dependent minerals and materials, not only must the National Defense Stockpile meet its objectives; domestic deposits of minerals and materials must be identified and developed. NAM is in full agreement with President Reagan's observation that:

> "New mineral deposits will not be found unless the private sector looks for them. It is to the nation's advantage to encourage this search. Government has a responsibility as owner of most of our better mineral lands to minimize unnecessary restrictions that limit that search. Economic use of our natural resources allows decisions to be based on full information of all values that are involved. Preservation of wilderness areas, for example, is an important goal that must be balanced against others, such as national security."

NAM believes that for much of the federal land withdrawn to date from development activity, resource potential information was sketchy, obsolete or nonexistent. We hope that Congress, in considering future withdrawals, will have complete and up-to-date information on which to base its decision. What we don't know can and will hurt us.

NAM appreciates this opportunity to testify, and looks forward to working with the Subcommittee on these issues. I will be pleased to respond to any questions you might have.

NAM DISCUSSION PAPER
ISSUES RELATING TO THE NATIONAL DEFENSE STOCKPILE

Stockpiling has long been recognized as a means to provide for national emergency needs. The National Defense Stockpile contains 61 families of strategic and critical materials, that together total 93 individual materials. The Strategic and Critical Materials Stockpiling Act defines stockpile materials as those which are needed to supply the military, industrial and essential civilian needs for national defense of the United States during a national emergency and are not produced in sufficient quantities within the United States.

The importance of stockpiling is underscored by the vulnerability of the United States' supply of a number of minerals. The U.S. has virtually no primary production of chromium, cobalt, columbium, manganese, platinum group metals, tantalum and titanium rutile. These minerals are key to defense industries, aerospace production and many commercial applications. Chromium, for example, is a necessary component in stainless steel.

The United States' import dependence in these materials is particularly dangerous because of the location of the sources of supply. Production of several of these minerals is concentrated in economically and politically unstable nations.

The United States' supply of strategic metals could easily be threatened by civil or economic disruptions in producing nations, interruptions of transportation routes or sea lanes, international events, wars, embargoes or cartel actions.

Congress has mandated that the National Defense Stockpile be sufficient to sustain the military, industrial, and essential civilian needs of the United States for at least three years in the event of a national emergency. Inventories of more than half of the 61 groups of materials in the stockpile fall short of their goals. Short sighted political and economic considerations have frequently taken priority over strategic issues in setting stockpile goals, and in buying and selling materials. Substantial revisions must be made in the management of the stockpile. Specifically, problems exist in the management authority over the stockpile, funding and the quality and quantity of materials held.

Stockpile Management Authority

Authority over and management of the National Defense Stockpile is fragmented and ineffective. Several agencies and Congress are involved in the approval of the stockpile transactions.

The General Services Administration (GSA) handles all of the buying, selling, shipment and storage of stockpile materials, but the Federal Emergency Management Agency (FEMA) chairs interagency formulation of the Annual Materials Plan (AMP). The AMP provides the basis for FEMA's establising stockpile goals, priorities and transactions decisions, subject to approval by the National

Security Council. These then are subject to review and approval by the General Services Division of the Office of Management and Budget (OMB). At the same time, budget requests of other major agencies with AMP responsibilities are processed through four other divisions of OMB. There is, therefore, no integrated review of the aggregate National Minerals and Materials program, and federal budgetary considerations have too often formed the basis for stockpile implementation, In addition, Congress ultimately must authorize releases or acquisitions as part of the annual budget.

This complex organizational structure makes stockpile transactions difficult and time consuming. Because it takes months to get approval from the executive office and Congress, acquisitions and releases are often poorly timed. A unified, direct management approach would permit stockpile policy to be more responsive to market conditions.

There are also doubts about whether the correct quantities of materials are maintained in the stockpile. Stockpile goals have been changed frequently in the past, but not always consistently. For example, at one time stockpile goals for aluminum, copper and nickel were set at zero. During the sixties and early seventies, most of the inventory of these materials was sold. New stockpile goals for these materials will require their purchase at current prices, which are far higher than when these commodities were sold. Stockpile management is often criticized for selling when prices are low and buying when prices are high. FEMA estimates that if the status quo of 1962 had been maintained, and these

large sales had not been made, the cost of acheiving today's stockpile goals would be minimal. Currently, $10.3 billion worth of material is needed to bring inventories up to goal.

Over the past 35 years, the targets of some materials have been changed as many as 10 or 15 times. Erratic changes in stockpile goals and inventories have been disruptive for both producers and users, and costly to the taxpayer. Cobalt serves as an example; the stockpile goal for this material was 129 million pounds in 1955 but only about 12 million pounds in 1973. Consequently, much cobalt was sold at prices averaging $2 to $4 a pound. Recently, the administration bought 5.2 million pounds of cobalt from Zaire for $15 a pound. In other words, we are paying $11 to $15 per pound more for cobalt today than we sold it for only a few years ago.

Because the President, OMB and the Congress all have direct influence over stockpile policy, abuses have often occurred for political or economic reasons. For example, President Johnson threatened to release aluminum from the stockpile to prevent price increases. The Nixon administration initiated a major sale of stockpiled goods to generate revenue to reduce Federal budget deficits. Similarly, the Reagan administration has been accused of failing to recommend adequate appropriations for the stockpile because of budgetary constraints. Stockpile actions motivated by political and budgetary considerations have caused damaging and unnecessary interference in commodity markets, and contributed to the insufficiency of stockpile inventories.

Recommendation #1

NAM believes that two fundamental principles should govern national defense stockpile management: (1) the stockpile should meet national defense needs only, not economic or budgetary purposes; and (2) the stockpile should be managed by a nonpolitical, independent body.

Funding for Stockpile Acquisitions and Sales

The Strategic and Critical Materials Stockpiling Act establishes a separate treasury fund known as the National Defense Stockpile Transaction Fund. All monies received from stockpile sales are placed in this fund, and are available for the acquisition of needed materials. The purpose of this fund is to have a source of revenue for stockpile acquisitions, without having to draw on the general revenues or compete with other budgetary priorities.

However, transaction funds are not automatically available for acquisition; they must first be appropriated by Congress. Congress and the President have been unwilling to use the transaction fund for stockpile purchases because of budgetary pressures. Because the fund cannot be used for other budget items, leaving the money in the treasury creates the illusion of a smaller deficit. The transaction fund becomes, in effect, an interest free loan to the treasury. According to the most recent stockpile report,* $182.2 million are currently in the fund. Yet

*"Stockpile Report to the Congress: October 1981-March 1982", September 9, 1982. Federal Emergency Management Agency, Washington, D.C., page 15.

the President requested only $106 million for stockpile purchases in 1982, and the Congress appropriated only $57.6 million. The GAO recently concluded that the Reagan administration's stockpile plan would have resulted in the accumulation of $1.8 billion in the treasury over the next five years, despite the fact that $10.3 billion worth of acquisitions are needed to bring deficient stockpile inventories up to their goals.

Recommendation #2

NAM supports purchases, sales or barter of materials needed to meet stockpile goals. NAM also favors amending the stockpiling act to make stockpile transaction receipts available for purchases without appropriation by Congress.

Stockpile Quality and Form

Serious doubts have been raised about the quality of stockpiled materials due to management, storage and handling practices. For example, it is suspected that 25 to 40 per cent of the titanium sponge in the stockpile may have deteriorated. The total extent of such problems is unknown.

Many materials in the stockpile were purchased in the 1950s and early 1960s, based on the technological standards of that day. Since then, technology has advanced dramatically. Much of the stockpile is out of date given today's more exacting materials specifications. For example, 40 to 45 million pounds of cobalt currently in the stockpile would require analysis or upgrading to meet current standards for rotating grade jet engine applications.

Periodic rotation of the stockpile is needed to maintain the quality and to prevent obsolesence. However, no major stockpile rotation purchases have been made since the original acquisitions of most of the materials. Thus, the current stockpile is based on technical specifications of 20 years ago. Present law allows rotation only when needed to prevent material deterioration; it does not take into account changing industrial technologies. Inadequate funding and the paucity of information on the quality of materials also prevent adequate rotation.

The form in which various materials are held has also been questioned. Metal can be held as unprocessed ore, as a semi-processed product, or in its end-use form. Much of our stockpile could be useless if too large a portion is held as ore that cannot be processed domestically.

Chromium, for example, is consumed and stockpiled in a number of different forms, including chromium metal, ferrochrome and chromite (chrome ore). Chromite is the largest component of the stockpile's chromium inventory. But because our domestic capacity to smelt chrome ore into ferrochrome is rapidly declining, the ratio between chromite and ferrochrome has been criticized. The appropriate mix of the forms of chromium and other metals should be examined. Consideration should be given to the status of our domestic processing industries and how the material flow--from ore to finished product--is likely to be affected by a supply disruption.

In his mineral policy statement, the President pledged to 'establish a panel, with appropriate private sector input, to

review the extent of material deficiencies and to recommend remedial action.' FEMA has committed funds to start this action this fiscal year and is working with the national materials advisory board of the National Academy of Sciences and the Federation of Materials Societies in this regard.

Recommendation #3

NAM recommends that the efforts which have been initiated to assess the quality and form of the stockpile, utilizing substantial advice from the private sector, be vigorously pursued to completion.

April 6, 1983

William A. Owczarski

Manager, Technical Planning
Pratt & Whitney Group

Dr. Owczarski, who has been manager, technical planning of Pratt & Whitney Group since 1980, joined the company as senior research associate in 1962.

From 1962 to 1971 he was involved in research and development in processing of high temperature materials. In 1972 he became assistant manager of the Materials Engineering and Research Laboratory and was responsible for development and application of advanced materials for use in commercial jet engines. In 1974 he was awarded the United Technologies Corporation George Mead Medal for engineering achievement.

He was also assigned as assistant manager of structural testing in 1980 prior to his present assignment.

A native of Massachusetts he received his bachelor of science degree from the University of Massachusetts in 1955 and Masters and PhD degrees in Metallurgical Engineering from Rensselaer Polytechnic Institute in 1958 and 1962.

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5/83

Area of Responsibility: He is currently responsible for interdivisional planning and technical coordination in materials, structures and manufacturing technologies for Pratt & Whitney Aircraft Group, United Technologies Corporation.

Previous Experience: In nineteen (19) years with Pratt & Whitney Aircraft he has held various previous positions including Manager, Applied Mechanics; Assistant Manager, Materials Engineering and Research Laboratories; Supervisor, Process Research, Advanced Materials Research and Development Laboratories (AMRDL) and Senior Research Associate, AMRDL. Prior to employment at Pratt & Whitney Aircraft he held positions at General Electric's Knolls Atomic Power Laboratories and at Sprague Electric Company.

Education: He received a Bachelor of Science in Electrical Engineering from the University of Massachusetts (1955), Master of Metallurgical Engineering (1958) and PhD in Physical Metallurgy (1962) from Rensselaer Polytechnic Institute.

Technical Organizations and Activities (Present):

Chairman, Non-Fuel Minerals Task Force, National Association of Manufacturers
Member, NMAB Committee on Assessment of the Need for Quality Determination of Non-Fuel Materials in the National Defense Stockpile
Member, American Society for Metals
Member, American Welding Society
Member, Society of Sigma Xi

Previous Technical Organization Activities:

Director, American Welding Society (AWS), 1969-75
Chairman, Long Range Planning Committee, AWS, 1971-75
Chairman, Educational Activities Committee, AWS, 1966-69
Chairman, Joining Division Council, American Society for Metals, 1977-80
Member, Industrial Advisory Committee, Carnegie Mellon University-Center for Materials Joining, 1975-80
Member, University Research Committee, Welding Research Council, 1968-73

Additional Information:

Author of 40 technical papers
Holds 11 patents
Comfort A. Adams Memorial Lecture Award, AWS, 1973
William Spraragen Awards, AWS, 1969, 1970, 1973
Fellow, American Society for Metals
UTC George Mead Medal for Engineering Achievement, 1974
Listed American Men & Women of Science, 1965
Listed Engineers of Distinction, 1970
Listed Whos Who in the East, 1971

January 4, 1983

Mr. GLICKMAN. Our next witness will be Dr. Timothy Stanley, president of the International Economic Policy Association in Washington, and then Dr. Tuesday is here, I believe, and if you would like to come to the table and sit to the left of Dr. Owczarski, it would be very much appreciated, and then we will ask you to testify after Dr. Stanley finishes.

Dr. Stanley, it is a pleasure to have you here today.

Dr. STANLEY. Thank you, Mr. Chairman. I indicate in the testimony that the thoughts I am expressing are my own, but that I have also attached the views of our board of directors on the subject.

Not surprisingly, the views of my board of directors are similar to the ones that Bill just indicated on behalf of the NAM. I have noted your press release of May 17, Mr. Chairman, in which you express concern over the administration's sense of commitment to the Nation's materials needs. I gather that your subcommittee has subsequently heard other testimonies reinforcing that concern. I would like to make the observation that this entire policy area referred to by Jim Santini and others has been in a condition of stasis—stoppage or paralysis—ever since the Korean war.

The administration has presented a program plan, and that is the first major initiative at least at the declaratory level, in 30 years. There are a few centers of leadership in following it up, such as the Department of Commerce; but in some quarters of the administration there seems to be firm opposition to making available the financial resources necessary to translate the President's plan into any real program.

There is a fundamental dichotomy between two contending schools of thought. One is those who believe that our dependence on foreign sources for a substantial number of critical and strategic minerals involves vulnerabilities and that these vulnerabilities represent risks to our national security and well-being, and they ought to be reduced. Another point of view is that markets are sufficiently elastic to meet shortages in less than an all-out war, and in an all-out war, if it were thermonuclear, the stockpile would be irrelevant, and that for other contingencies, the cost of insurance would be too high.

It is difficult to talk about this subject in general, but there are about a dozen nonfuel minerals on which we do have a vulnerability because of their critical nature, inadequate domestic or other alternative sources, including substitution, and which also have a substantial possibility of disruption from specific contingencies. These include aluminum/bauxite, chromium, cobalt, columbium, fluorspar, manganese, the platinum group, tantalum, titanium, and tungsten. Depending on the circumstances, I could add several others.

In 1980 Resources for the Future issued a major study on world mineral trends and U.S. supply problems. I have appended to the statement a chart which is my summary of their analyses of probabilities of shortage for the particular minerals they were asked to study.

I happen to regard their judgments as a bit on the optimistic side, but even so the point I want to make is that even if there is only a moderate, 20 to 25 percent possibility of medium- to long-

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term shortages of medium size, that is 20 to 50 percent shortfalls from normal consumption of a single material, for example chromium, the probabilities that one or more of this group will encounter a major supply problem are much higher.

This is an oversimplified analogy, but if you had a man canoeing down a river that had rocks in it and the probability of hitting any one of them is, say, 10 percent, his escape probability would be 90 percent. If there are two rocks, that falls to 81 percent; if 3, 73 percent; and so on. My point is if there are as few as six rocks in the river there is less than a 50-50 chance of not hitting one of them. If the probability is, say, 20 percent, there need only be four rocks before the escape probability becomes less than 50 percent.

There are various studies that have shown the consequences to the U.S. economy of a sustained shortage of a single material like chromium or cobalt. They show that, depending on your assumptions, it could run to billions, even tens of billions of dollars. The consequences of that shortfall could be quite serious.

I realize that we cannot assign actual probabilities, except by just guessing, to such contingencies as: turmoil in South Africa or Zimbabwe, guerrilla warfare in Zaire, new outbreaks of resource nationalism in the Caribbean or Brazil, or even developed countries such as Australia or Canada. But I think it is self-evident that there are a lot of rocks in the natural resources river. In that same river are a lot of our industrial competitors, many of whom have developed risk-management programs.

So the administration is in the somewhat awkward position of having declared that there are risks, but refusing to pay the insurance premiums to meet them.

If we view these premiums in a risk-management context, the cost is not very high in relation to the possible damage we would suffer. Perhaps we are talking about $2 billion or $3 billion over a 5-year period in which military defense programs are going to be spending more than $1½ trillion.

I will not try to spell out the risk-management options that we have. I know the subcommittee staff has copies of our studies. To tick them off: Bill has touched on improvements in the national defense stockpile; there are possibilities of increased incentives for greater private stockpiling; improved domestic production and especially processing that Mr. Santini mentioned (title III of the Defense Production Act could be used for that purpose); a better balance in environmentally sound, multiple-use arrangements for the minerals potential on public lands, or at least a better inventory of what is there; case-by-case adjustment to processing and environmental standards where these can be certified to be necessary for a particular strategic material, say cobalt; improved conservation and recycling; and research and development, which your committee has very helpfully focused on.

I would just endorse what the previous witness said about the need for the stockpile Transaction Fund, not only to be off-budget, but to be able to spend receipts from the stockpile disposals for acquisition without having to go through the appropriation process.

On R&D, you have heard so many expert witnesses, that all I can say is that as a layman I am encouraged by what the experts say about the potential for ceramics and solidification technology.

I would like to mention one aspect of that. As you know, the IRS regulations on section 861 as proposed require allocation of R&D expenses to foreign income, which foreign governments often do not recognize, so they are tending to have a negative effect on U.S. research and development, which Congress is trying to encourage. That is, companies are trying now to shift more of their R&D abroad, essentially for tax purposes. There is legislation designed to extend the moratorium on those regulations introduced in both Houses, and I hope that it might receive favorable consideration by your subcommittee.

The last item is diversification. We get a large percentage of our essential raw materials from a handful of countries. Clearly one could reduce the risk if one could encourage the various programs to diversify to others. I would also like to see this subject given a higher priority in our overall foreign economic policy with respect to both the supplier countries and our major allies and fellow consuming countries.

In conclusion, I believe that there are risks to our national security and our economic health. I believe that there are tools and options available for managing those risks in a cost-effective way. All that is required to do is for the President to assign the requisite priority and the responsibility—and not heed those of his advisers who seem to regard the problem as infinitely postponable.

While I am sympathetic to the idea of an independent body in the Executive Office of the President, the administration says it is not, and it will oppose any such legislation. But I think some of what is needed could be accomplished if they would establish, preferably by statute, a Deputy Special Assistant to the President for National Security Affairs, who would be assigned specific responsibilities for overseeing the annual materials plan, which is now done at a lower level by FEMA; the needed improvements in the stockpile; and the interrelated work of the Emergency Mobilization Preparedness Board; plus analysis of many of the other risk options that are available. In short, we can reduce our risks in the materials field at acceptable costs if we will just put somebody at the top in charge and give him that mandate.

Thank you.

Mr. GLICKMAN. Thank you.

[The prepared statement of Dr. Stanley follows:]

STATEMENT OF TIMOTHY W. STANLEY
PRESIDENT, INTERNATIONAL ECONOMIC POLICY ASSOCIATION
TO THE
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS

JUNE 24, 1983

"Materials Vulnerabilities and Risk Management"

Mr. Chairman:

I thank you for your invitation to appear at these oversight hearings on "The National Materials and Minerals Policy Research and Development Act of 1980" with particular attention to how we can better manage the risks involved in our strategic and other materials vulnerabilities.

The International Economic Policy Association and the International Economic Studies Institute, of which I am also President, have both done substantial work in this area, with particular regard to the interactions between U.S. natural resource needs and foreign economic policy. In this work we have had the benefit of advice from an expert Committee on Natural Resources drawn from U.S. companies which are primarily materials consumers but also represent producer and supplier points of view. However, the thoughts I will express here today are my own. They should not therefore be taken as necessarily reflecting the formal viewpoint of any particular company. I have, however, annexed to my statement for the record the policy views of our Board of Directors on this subject; and I think they represent a reasonably broad consensus in industry.

I have noted, Mr. Chairman, that on May 17th, the Committee issued a release in which you expressed concern over the Administration's "sense of commitment to the nation's materials needs and

opportunities." I gather that the Subcommittee has subsequently heard other testimonies which were critical as well. So I would like to start out with the observation that this entire policy area has been in a fundamental condition of stasis, i.e., stoppage or paralysis, ever since the Korean War, the last time there was a widely accepted condition of national emergency.

To be sure, the Reagan Administration presented a program plan last year -- the first major initiative (at least at the declaratory level) in thirty years -- and there are a few centers of leadership in following it up, such as the Department of Commerce, which you rightly complimented in your release, Mr. Chairman. But in some quarters of the Administration, including OMB, there seems to be firm opposition to making available the financial resources necessary to translate the President's plan into a real program.

Over many years, there has been a constant struggle both within the bureaucracy, reflecting competing interests such as minerals producers and environmentalists, to cite only one example, and between the administration in power and the bureaucracy which have effectively checkmated each other. When administrations were basically unsympathetic to the defense stockpile, the career people mounted a rear-guard action to save it; while, as noted, when an administration has been sympathetic to it, budgetary considerations have tended to dominate.

I therefore thought it might be useful to attempt to deal briefly in this statement with the fundamental dichotomy between two contending schools of thought. These are: 1) Those who believe that our dependence on foreign sources for a substantial number of critical and strategic minerals involves vulnerabilities which are risks to our

national security and well being, and which must be reduced; and 2) Those who argue that markets are sufficiently elastic to meet shortages in less than an all-out war, that the national defense stockpile would be irrelevant in a massive thermonuclear exchange, and that for other contingencies, the costs of insurance are simply too high.

Congress has authorized and funded the present stockpile for purposes of national defense, but budget cutters use the second point of view to resist any improvements in it!

My own view is that there are about a dozen materials on which our "dependence" on overseas sources becomes a "vulnerability" because of their critical nature, inadequate domestic or other alternative sources, including substitution, and which have a substantial possibility of disruption from specific contingencies. These include alumina/bauxite, chromium, cobalt, columbium, fluorspar, manganese, the platinum group, tantalum, titanium, and tungsten. In some circumstances one could add beryllium, copper and molybdenum, and perhaps one or two others.

Although I could give my own subjective estimate of various types of risks and probabilities of their occurrence, the point is better made by drawing on an objective analysis by a respected group. In 1980, Resources for the Future issued its major study on World Mineral Trends and U.S. Supply Problems and I have appended to this statement a chart which summarizes and condenses their analyses of probabilities of shortage for the seven materials they were asked to study, namely aluminum, cobalt, chromium, copper, manganese, lead and zinc. And

of course, this does not include the platinum group, tantalum and titanium which many sources, including the Congressional Research Service,* have cited as involving vulnerability for the U.S.

I personally regard the Resources for the Future estimate of probabilities as on the conservative side, that is, somewhat optimistic. Nevertheless, my basic point is that even if we accept that there are only "moderate" (20-25 percent) possibilities of medium- to long-term shortages of medium size (defined as 20-50 percent shortfalls from normal consumption) for any particular material, the cumulative probabilities that one or more of the group will encounter a major supply problem are much higher.

To illustrate this point, imagine a man canoeing down a river with a certain number of potentially dangerous rocks. If the probability of hitting any one is, say, 10 percent, then his "escape" probability is 90 percent. If there are two rocks, that falls to 81 percent; if three, 73 percent, and so on; so that if there are as few as six rocks, our canoeist has less than a 50-50 chance of emerging unscathed. And if the probabilities are, say, 20 percent (what the chart shows as the moderate range) there need only be four rocks before the escape probability becomes less than 50 percent.

Various studies have shown that the consequences to the U.S. economy of a sustained shortage of a single material like chromium or cobalt could run into several, even tens of billions of dollars.

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* "Congressional Handbook on U.S. Materials Import Dependency/Vulnerability," Report to the House Committee on Banking, Finance and Urban Affairs, Washington, GPO, 1981.

I recognize, of course, that no one can assign actual probabilities, except in terms of guesses about orders of magnitude, to such contingencies as: turmoil in South Africa or Zimbabwe, guerrilla warfare in Zaire, Soviet manipulation of its own or client-state resources; new outbreaks of resource nationalism in the Caribbean or Brazil, or even in such developed suppliers as Australia or Canada. But I do think the conclusion is self-evident that there are a lot of rocks in the natural resources river which the United States must navigate. And we do so along with other industrial competitors, many of whom have developed risk-management programs of one type or another such as the European Community's Lomé Convention and Sysmin development fund.

So it seems to me that this Administration is in the somewhat awkward position of having declared that there are risks warranting, to use another analogy, some economic and security health insurance, but refusing to pay the premiums for such insurance at more than a token level.

If we view these premiums in a risk management context, however, their cost is really not very high; perhaps 2 or 3 billion dollars over a five-year period in which military defense programs exceed a trillion and a half dollars!

I will not try to develop the various options that exist, since time is short, and since my views were spelled out in an essay last year of which the staff have copies.* But very briefly, they include:

* "A National Risk Management Approach to American Raw Materials Vulnerabilities," International Economic Studies Institute, Contemporary Issues No. 5, Washington, 1982.

(1) improvements to the national defense stockpile, which has been discussed by many other witnesses before your Committee; (2) the possibility of public incentives for increased private stockpiling, which is the subject of a report we will publish shortly; (3) improved domestic production and especially processing capability, at least in a standby mode using Title III of the Defense Production Act; (4) a better balance in environmentally sound, multiple-use arrangements for the minerals potential on public lands (as a minimum to include more effective inventorying of potential resources there); (5) case-by-case adjustment to processing and environmental standards where these can be certified to be necessary for a particular strategic material such as cobalt; (6) improved conservation and recycling; and last but not least, (7) research and development into substitution, which has been a particular focus of this Committee's attention.

Although the stockpile is our most important risk management tool, it needs upgrading in quality, more rapid movement toward disposal of excesses and acquisition of materials where there is a major shortfall between inventory and established goals, and updating of the goals themselves in light of new technologies and changes in industrial inventory practices. Most of all, in my opinion, it needs an off-budget, revolving fund status for the Transaction Fund, so that managers can accomplish this movement without having the funds generated by sales returned to the general revenues -- as OMB evidently desires. A Treasury ruling to that effect is, I understand, still being contested by OMB. Perhaps Congress needs to reinforce its intentions by more specific statutory language.

Possibly the second most important tool, over time, is to decrease our use of materials in which we are most vulnerable through the development of substitutes such as ceramics, carbon matrix composites, and solidification technology. I hasten to add, Mr. Chairman, that I have no expertise in this area but am encouraged as a layman by what I hear from the experts. Since other witnesses before your Subcommittee have covered this aspect in great detail, I will conclude with one other tool not previously mentioned, which may have significant potential.

This might be called a combination of diversification from the presently quite limited number of overseas sources, and making raw materials a more significant component of our overall foreign economic policies (including aid, trade, national security, tax and investment policies) with respect to both key supplier countries and our major allies. Again, time precludes developing this; but several years ago my colleagues and I published a major study of this particular aspect which I should be pleased to give to your staff if they do not already have it.*

In conclusion, I believe that there indeed are risks to our national security and our economic health in the materials field. I believe that there are tools and options available for managing those risks in a cost-effective way; and all that is required to do so is for the President to assign the requisite priority and responsibility --

* International Economic Studies Institute, Raw Materials and Foreign Policy, Westview Press, 1977.

rather than to heed those of his advisors who regard the problem as "infinitely postponable," as one long-time observer of this subject has termed it.

If that is done, then I believe there should be a clearer responsibility, centered in the National Security Council, for pulling together the necessary program support and coordinating the functions of Commerce, Defense, Interior, State, FEMA, GSA, and OSTP, to cite only a few of the important actors on this stage.

In other writings I have proposed a National Materials Risk Management Board in the Executive Office of the President; but the Administration opposes the creation of any additional organizations. The National Security Act of 1947, which established our basic post-war structure for coordinating foreign and defense policy, placed the subject squarely within that framework via the now long-defunct National Security Resources Board. I believe it is time that it was returned there, and that a Deputy Special Assistant to the President for National Security Affairs should be established by statute in the NSC. He should be assigned specific responsibilities for overseeing: the Annual Materials Plan and the needed improvements in the stockpile; the related work of the Emergency Mobilization Preparedness Board; and the analysis, and implementation where appropriate, of the many other risk management options that are available. In short, we can reduce our risks in the materials field at acceptable costs if we have the will to put someone at the top in charge with exactly that mandate.

Thank you, Mr. Chairman.

SHORTAGE PROBABILITIES*
(Seven Materials)

Probability (shortfalls from consumption rates that would have prevailed at previous price levels)	DURATION: VERY SHORT (less than 2 months)			SHORT (2 - 6 months)			LONG (more than 6 months)		
	Small (0-10%)	Moderate (10-25%)	High (over 25%)	Small (0-10%)	Moderate (10-25%)	High (over 25%)	Small (0-10%)	Moderate (10-25%)	High (over 25%)
SMALL (0-20%)		zinc[3]	cobalt chromium[1] manganese[2] alumina copper[3] lead[3]		cobalt chromium manganese alumina zinc	copper lead	manga-nese alumina	cobalt chromium zinc	copper lead
MEDIUM (20-50%	zinc	cobalt chromium manganese alumina copper lead		cobalt manga-nese alumina zinc	chromium copper lead		cobalt manga-nese alumina zinc	chromium copper lead	
LARGE (50-100%)	cobalt manga-nese alumina copper lead zinc	chromium		cobalt chromium manga-nese alumina copper lead zinc			cobalt chromium manganese alumina copper lead zinc		

Notes
1-includes chromite & ferrochromium
2-Ferromanganese
3-Refined

* Adapted with permission from Resources for the Future, Leonard L.Fischman, Project Director, World Mineral Trends and U.S. Supply Problems, The Johns Hopkins University Press, Baltimore, 1980, Chapter 9, Tables 9-1 through 9-7. Note: Minor adjustments have been made in combining RFF's charts for the individual materials into a single matrix for purposes of simplification. These are the responsibility of the writer, not RFF.

ANNEX

IEPA VIEWS ON NATURAL RESOURCE ISSUES*

It is clear that the government's natural resources policies and actions to date relating to external resource dependence have not fulfilled the implicit promises contained in the 1980 Republican Platform and in the work of the task force set up to deal with strategic nonfuel minerals during the transition. The Administration's April 1982 "National Materials and Minerals Program Plan" is a step forward in enunciating a policy; but effective implementation has been blocked by OMB opposition and organizational shortcomings. This is not an area in which action can be either neglected or indefinitely postponed. As noted in the IESI 1976 study, Raw Materials and Foreign Policy, the United States is increasingly dependent on potentially unstable, insecure, or cartel-prone sources for the majority of its critical and strategic materials -- materials which are vital to both domestic industrial production and national security. No set of studies, policies or actions since the publication of that study has done anything to substantially alter this conclusion.

With respect to energy and imported petroleum -- which has driven the world economy downward more than any other single factor during much of the past decade -- there has also been little constructive movement in policy. The current oil glut is a direct result of the world recession, although it also reflects the cumulative impact of conservation and substitution.

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* As approved by the Board of Directors, January 1983.

Opinions differ as to whether OPEC will ever again be able to attain the dominant position it held in the seventies and to escalate prices by fiat. But it is clear that this could result from a combination of unwise policies by consumer countries, especially the United States, and a sustained economic recovery starting in the mid-eighties.

Although there has been progress in filling the Strategic Petroleum Reserve, uncertainties and declining prices in the energy market threaten to destroy the infant synfuels industry as well as the progress that had been made in renewable energy alternatives. Action is therefore needed, as a minimum to achieve the operation of a pilot synfuel facility, if necessary by direct government subsidy, and possibly to establish a minimum landed price for imported petroleum to preserve energy alternatives.

In the light of the foregoing, we support the present Administration's refusal to substantively participate in, or legitimize, international commodity schemes that would effectively interfere with the efficient operation of the market mechanism, but we support eventual U.S. adherence to the Law of the Sea Treaty with the minimal essential modifications to the seabed resources provisions which the U.S. has opposed.

The U.S. should avoid cartel or other manipulation of commodity prices as a form of "development aid." Where international action is needed, there are advantages in the European Community's Lomé Convention approach, which emphasizes support for export earnings (instead of price manipulation) and contains pay-back discipline for those LDCs who can afford it when materials market prices rise.

IEPA will continue to contribute to the formulation of national policy in the nonfuel minerals area, supporting measures to reduce particular vulnerabilities to external cutoff or cartel action, while opposing efforts to establish economic buffer or price stabilization stockpiles. We support realistic efforts to improve U.S. contingency response capability by extending the Defense Production Act and by modest funding of Title III of the Act, plus authority and funding for meaningful progress toward meeting the National Stockpile's approved acquisition goals -- in which context the transactions fund should be moved off budget. We seek effective implementation of the National Materials and Minerals Program Plan and better input from potential industrial users with regard to evaluating the adequacy and quality of the stockpile inventory; and we support measures including incentives, where cost effective, which will encourage private-sector stockpiling of critical materials.

The government should adopt a more rational (and continuing, rather than ad hoc) mechanism to provide for information, data evaluation, and policy planning in the area of natural resources and improve industry-government cooperation. Such a mechanism might best be developed under NSC auspices, perhaps in conjunction with the Emergency Mobilization Planning Board which is chaired by the NSC Assistant to the President. Where feasible, this arrangement should provide for better information exchanges with other industrial countries, for example through OECD.

With regard to energy, the U.S. should pursue policies which will restore market forces to control of the international oil and energy

field and develop risk management measures for contingencies of supply interruption, to include government support for the pilot development of synfuel facilities using coal and shale which could be expanded in a new emergency.

The costs and benefits of possible import fees or variable levies on imported petroleum (with the objective of putting a floor under the landed costs, so that the development of energy alternatives in this country cannot be undercut either by short-run market forces or deliberate cartel action) should be analyzed, taking account of the special case of petrochemical feedstocks.

Any return to energy profligacy or government inattention to energy policy issues and Middle East contingencies as a sustained recovery gets underway can pose serious dangers to the nation.

Biographical Sketch

TIMOTHY W. STANLEY is president of the International Economic Policy Association. IEPA is a nonprofit research group, based in Washington, specializing in international business and public policy problems in the economic area. Its members are a diverse group of leading U.S. companies with extensive international operations. Dr. Stanley also heads the affiliated International Economic Studies Institute, which does research on longer term problems such as the interactions between raw materials and foreign policy and between energy, economics, and international security.

He received his A.B. from Yale and both an LL.B. and Ph.D. from Harvard, following two tours of military duty. He has taught at Harvard, George Washington, and Johns Hopkins Universities and he served for many years in the U.S. Government. There he held positions in the International Security Affairs area of Defense, the White House Staff, the State Department, and the Arms Control and Disarmament Agency. He served for over four years at the U.S. Diplomatic Mission to NATO in Paris and Brussels where he was Defense Advisor and Minister and received the Distinguished Civilian Service Medal.

He is the author or co-author of numerous books and articles on international political-economic and defense policy subjects.

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Mr. GLICKMAN. Dr. Tuesday, it is a pleasure to have you here. Did you come from Detroit this morning?

Dr. TUESDAY. I did with a plane that was a little late.

Mr. GLICKMAN. This subcommittee has been to the Tech Center several times. I have been one time, and I was very impressed and appreciative.

Dr. TUESDAY. I have a brief statement, so I would like to read the whole statement.

Good morning, I am Charles S. Tuesday, technical director of chemical and materials sciences at the General Motors Research Laboratories in Warren, Mich. I am very pleased to be here today, and thank you for the opportunity to provide the subcommittee with our views on the research, development, and use of advanced materials.

The development and incorporation into our products of advanced materials is of utmost importance to General Motors and has been for many years. In that context it should be remembered that many of the materials in common automotive use today were at one time or another considered advanced materials. Examples would be automotive catalysts and the many plastics and elastomers now in common use.

There has been a recent acceleration of new material introduction in the automotive industry, motivated by the desire to decrease vehicle weight and, thus, improve fuel economy. This introduction of new materials is exemplified by two new General Motors vehicles, the recently introduced 1984 Chevrolet Corvette, and the 1984 Pontiac Fiero to be introduced later this year.

The new Corvette continues to be the only U.S. production car with an all plastic body. The material used is a fiberglass polyester composite which together with new processing technology results in improved panel appearance. The new Corvette front and rear springs, however, are of particular significance from a materials viewpoint. These springs are made from an advanced polymeric composite containing filament-wound continuous glass fibers in an epoxy resin matrix. Using this advanced material, each spring weighs only 8 pounds, while a comparable steel spring would weigh 40 pounds.

The new Pontiac Fiero will utilize a steel space frame to which plastic body panels will be attached. Some of the panels will be made of the same type of polymeric composite used on the Corvette. Others, however, will use reaction injection molded polyurethane panels which are reinforced with glass flakes. These panels are somewhat flexible, resulting in what is called a friendly fender, a fender that can absorb minor collisions and bounce back undamaged.

Although General Motors is constantly searching for new materials, the introduction of these new materials into production is moderated somewhat because General Motors is in a mass production, consumer-product industry. One moderating factor is the cost effectiveness of the new material. This includes not only the cost of the material itself, which might be quite competitive, but also the processing cost, including both labor and processing time. Some of the more advanced polymeric composites now used in the aerospace industry currently require very long processing times, so that the

cost effectiveness of these composites is not yet in the automotive ball park.

Another moderating factor is the unknown durability of new materials in the hands of the consumer. Through the years, accelerated laboratory durability tests have been developed for the more familiar materials that are known to correlate with field experience. For new materials—almost by definition—no such correlations between laboratory and field results exist, so that their introduction into production must, by necessity, be gradual.

New materials used by General Motors are developed by a number of different sources. The most important source is the large, diverse materials industry itself, where there is considerable interindustry as well as intraindustry competition. Another source for new material development is collaboration between General Motors and companies in the materials industry. A recent example is the development by the GM Research Laboratories of a new steel alloy that we called GM 980X—a dual phase steel. This alloy has both high strength, which permits weight savings, and good formability for ease of manufacturing. This combination of properties was not previously available. We developed this new alloy in collaboration with a steel company which went on to commercialize it. It is now being produced by two steel companies and is used in production for a number of different automotive parts. I would like to emphasize that this collaborative material development process is not new but has been going on for a long time. Marketplace demands and the competitive nature of the automotive industry have dictated a continuing need for the development of new materials.

There always has been and continues to be a large amount of materials R&D in this country. This R&D is carried on by the materials industry itself, as well as by the various materials user companies such as GM. We do not believe that any additional Federal R&D effort to develop specific materials for specific consumer industries is warranted. In fact, such a Federal role might actually be counterproductive, either by discouraging industry's R&D effort or because of misplaced Federal R&D priorities.

To aid in the development of new materials, we believe that the Federal Government should instead continue to support basic research in the materials sciences, developing new knowledge that the materials and user industries can use. The basic research done in universities would also aid in new material development by increasing the supply of trained materials scientists. The Federal Government should continue to directly support the development of the special advanced materials required in the defense and space programs.

All materials depend upon an adequate supply of raw materials. As this subcommittee well knows, the United States is dependent upon foreign sources for many strategic and critical materials. Some of the raw materials on the critical list are also very important to the automotive industry. This would include chromium, manganese, and nickel used as alloy elements in various steels, aluminum, and the noble metals which are essential elements in automotive catalysts. Therefore, we support the maintenance of an adequate stockpile of strategic and critical raw materials. However,

with regard to stockpile specifics, we defer to those in the raw material industries who have more knowledge about this subject.

Thank you again for this opportunity to testify. I would be pleased to answer any questions you might have.

[The biographical sketch of Dr. Tuesday follows:]

DR. CHARLES S. TUESDAY

Dr. Charles S. Tuesday is the Technical Director of Chemical and Materials Sciences of the General Motors Research Laboratories, Warren, Michigan. He received his AB from Hamilton College and his MA and PhD in Physical Chemistry from Princeton University.

Dr. Tuesday joined the General Motors Research Laboratories in 1955, where he specialized in atmospheric chemistry research. He advanced through various positions, becoming head of the Fuels and Lubricants Department in 1970. In 1972, Dr. Tuesday became head of the Environmental Science Department and acting Head of the Physical Chemistry Department.

Dr. Tuesday became a Technical Director in 1974 and currently directs six research laboratories departments: Analytical Chemistry, Electrochemistry, Fuels and Lubricants, Metallurgy, Physical Chemistry and Polymers.

He is a member of the American Chemical Society, the American Association for the Advancement of Sciences, the American Society for Testing and Materials, The Society of Automotive Engineers, Phi Beta Kappa and Sigma Xi.

Dr. Tuesday is also an ACS Corporation Associate, a former member of the Advisory Board of the ACS publication Environmental Science & Technology, and is currently a member of the Advisory Board for the Advances in Chemistry Series and the ACS Symposium Series.

Mr. GLICKMAN. Thank you very much, Dr. Tuesday.

Dr. Owczarski, in your statement you indicate that the NAM has recommended the creation by statute of an office or council of minerals or materials within the Executive Office of the President to insure that the previous statutes are fully implemented. And you also indicate in your testimony I believe that such a council would be more effective than the current administrative implementation organization. Does that effectively mean that you support in essence the legislation that—if you know anything about it, the Critical Materials Act of 1982, which we tried to pass through the House last year that created such a council?

Dr. OWCZARSKI. In at least a broad sense; yes. I do not recall all the specific details of that particular legislation, but as we did indicate in the testimony, we certainly would like to see a council in the executive branch that would be permanent by statute, that would not be turned off or turned on by the whims of a given administration or the lack of interest on the part of a given administration. We would hope that it would be placed in the executive branch in such a way that it could be aware of the broad implications of policy in other areas, and how they might impact on materials and minerals issues.

Mr. GLICKMAN. I mention that because when we tried to pass it through the House last year, and it was under the suspension calendar, which meant that it had to get a 2 to 1 margin to pass it, we had administration opposition to this because they like the status quo. But I did not detect that a lot of Members of Congress had at least at the time a feel for the problem: materials, minerals, and what they all do. I think that now that they do that having NAM's support and having that support conveyed to Members of Congress, assuming you would support the specifics of any bill that is introduced, would be helpful in letting people know that this is not an

abstract problem—this relates to jobs, to productivity, to corporate profits, to competitiveness—and that you, representing one of the major business organizations in America, believe that having some sort of government coordinating role is a useful response to the problem. So I take that if, in fact, you would support the specifics of the legislation, you might be willing to convey that to some of my colleagues who might need a little convincing.

Dr. OWCZARSKI. I think the members of our task force will be very interested in seeing forthcoming legislation, now that since February of this year, we have an approved policy statement. I am sure we will be more active in supporting legislation that we can agree with.

Mr. GLICKMAN. Let me ask you something: how innovative are our basic materials industries like steel and aluminum, and how do they compare with basic materials industries in other countries?

Dr. OWCZARSKI. My personal expertise is not in the very basic industries. I think we have seen evidence that there is in this country a fairly high level of sophisticated materials technology by virtue of some of the things that we see in the specialty metal industries. I think that we all see problems in the basic industries. My guess would be that that is not purely a question of technical or innovative ability as much as it is of many other problems that impinge on those industries.

Mr. GLICKMAN. You expressed a view that the stockpile should be used to meet national security needs, not economic or budgetary needs. Do you see private as opposed to public stockpiles as a means of handling economic problems associated with our Nation's vulnerability to supply shortages? Does Pratt & Whitney have such a private stockpile?

Dr. OWCZARSKI. I had hoped that I would be testifying on behalf of NAM, and——

Mr. GLICKMAN. You never know what happens when you come to one of these hearings.

Dr. OWCZARSKI. I will answer. To my knowledge, we do not have a private stockpile. And part of the reason for that, is that we do not buy materials in a very close to raw material state. We buy materials in a very close to finished product form. We buy forgings, castings, et cetera. So that is not an easy kind of material to stockpile. We have a very long chain of suppliers that have to be incorporated in the preparation and supply of materials to our final product.

Mr. GLICKMAN. What about the issue of public as opposed to private stockpiles generally?

Dr. OWCZARSKI. Well, I think in the testimony we have certainly supported the concept of a national defense stockpile. We think that the stockpile itself is a good idea. It is unfortunate that so many mistakes, or errors that have happened in the past have rendered the stockpile far less effective than it could have been. For this reason we have supported significant changes in the manner in which the stockpile is managed and would like to see a more coherent organizational structure to manage the stockpile.

Mr. GLICKMAN. I guess my question is that national security is by definition a kind of a strange animal. Does that mean you need alloys for an F-15 or does that mean that you need alloys for a

strong competitive steel industry, which also relates to national security in a more indirect way? I guess what I am saying is that if you take a very narrow definition of national security, then you have a stockpile that just provides for things that are only on the assembly lines of the Boeings and Lockheeds and General Dynamics and whoever else are building military hardware. In fact other things may relate in the long term even more to national security than those things.

Dr. OWCZARSKI. Well, the existing stockpile legislation does make provision for essential civilian needs and a broader range of materials than just purely defense products. I think that we have been very satisfied with the definitions in the existing legislation. In fact most of the materials in the stockpile are not very nearly to finished product. They are raw materials.

Mr. GLICKMAN. You are concerned more with the management and the budgetary implications of how the stockpiles are run—I think Dr. Stanley talked about this, too.

Dr. OWCZARSKI. We are certainly interested in how the stockpile is managed and how it could be drawn together into a more coherent overall structure and how it could be implemented more effectively if it were not spread out so far and wide among Government.

Mr. GLICKMAN. Dr. Stanley, do you have any thoughts on this line of questioning?

Mr. STANLEY. Yes, sir. I might address the private stockpiling possibility. The central thought behind it is simple, that the Government is not at the present level of funding ever going to reach anything like the goals for things that are supposed to be in the stockpile. Second, that given the high cost of inventories today business is tending to cut down rather than expand its own inventories, and that it might be in the public interest if business could be encouraged by one kind of incentive or another to increase its stocks over and above its normal inventories, so that the country would have additional materials for various contingencies of cutoff. This is controversial because you are talking about some form of subsidy. I thought it might be half and half, with the Government in effect matching what industry would be willing to do. There would then have to be certain conditions on the access to the additional stocks acquired from public funds, and that is a complicated question. In principle the idea does have merit. We are studying it and will have a report out in a couple of weeks.

Mr. GLICKMAN. Getting away from the stockpile and going back to the materials question, you indicate that a clearer responsibility for program support and coordination should be established within the National Security Council. Is this the best administrative mechanism for such materials activities? Why not the Council on Economic Affairs? And in addition to that question, I wonder if you could explain more fully your idea of a National Materials Risk Board?

Mr. STANLEY. I think the concept of the Board is very similar to the Council in the legislation that you referred to. There have been a number of proposals for councils or boards. The administration has been so adamant against creating any new such organizations that I was trying to find a way that might meet their objection and at the same time get some sense of order and management in this.

The National Security Council already has the responsibility for the Emergency Mobilization Preparedness Board. It seems to me that this stockpile function, in other words, the coordinating function that is now done at too low a level by FEMA, could be done there, if you had somebody with the stature. I think that is less preferable than an organization such as you described, but it may be better than nothing.

Mr. GLICKMAN. Dr. Tuesday, one of the interests of this subcommittee for some time has been trying to determine what the appropriate Federal role is in automotive research areas. The auto industry, General Motors as well as the other companies, has generally echoed your statements that you think that basic research is fine, even in materials sciences, but that there is this kind of implication that any additional Federal R&D to get any more specific than basic research is unwarranted. You state in fact such a Federal role, dealing with specific consumer industries, might actually be counterproductive by discouraging industry's R&D effort or because of misplaced Federal R&D priorities. What misplaced Federal R&D priorities are you talking about?

Dr. TUESDAY. Currently, of course, the research interests of the material industries are dictated by what they perceive that the marketplace wants and can afford. There is a belief that if the Federal Government got into the R&D sector by developing specific materials for a specific industry, that industry would be discouraged from doing its own R&D because it would no longer have a proprietary right to what it develops since the Federal Government, because of its size, probably has a larger effort than any individual company. The Federal Government, not being aware of the marketplace, might develop a specific material for which there is no market. Perhaps more importantly, the big thing that holds up the introduction of advanced materials into the consumer products industry is not the development of products themselves, it is making those materials cost-effective. This has to do with commercializing the production of that material and its processing. This is an area in which the Federal Government has very little experience.

Mr. GLICKMAN. I must tell you that that position is almost 180 degrees different from the position that Admiral Inman took before you got here in the Government role in the microelectronics, information-based, computer-type industries. He did not advocate the Government coming in and totally directing the research role. Clearly he was looking for a more cooperative model on research with government than the auto industry has. And I am wondering if you are not sowing the fate of your own doom in terms of the auto industry, in terms of attitudes on relationship with government in the R&D-type side of the picture.

Dr. TUESDAY. You mean me personally or General Motors?

Mr. GLICKMAN. I mean auto companies.

Dr. TUESDAY. I guess it is largely based on our experience so far with the Federal Government. We reiterate the view that we think we have developed materials which are quite competitive. As you are aware, the Japanese automobiles are doing well in the market, but you will not find advanced materials in any of them. You will find the advanced materials in the models made here. In terms of

advanced materials for the automotive industry, I think the industry is way ahead—at least it appears to be ahead.

Mr. GLICKMAN. Let me get to the area of ceramics. The Japanese are currently investing heavily in a broad program of ceramic materials R&D to develop a new ceramic engine. I know your company is aware of that. We talked about it at the technology center. This subcommittee has worked on heat engine programs in which General Motors is a participant in those. But I would wonder, it appears to me that the American auto companies are not making the very aggressive push in the ceramics area for engine purposes that the Japanese are. Maybe you want to dispel that notion on my part. What is the auto industry focus on ceramics? What would be the impact of such an engine development on the domestic automobile market, and are the Japanese ahead of us in this area?

Dr. TUESDAY. I would be glad to answer those questions, but not for the automotive industry, I will answer for General Motors. We have ceramic programs. We however do not discuss our research programs in the newspaper. We do them because of competition in our own laboratories.

As you are aware, the Detroit Diesel Division of General Motors has a contract with the Department of Energy to develop a ceramic gas turbine which because of the properties of ceramics will give high fuel economy, which is one of the drawbacks of gas turbines.

If we are talking in general, ceramics is a general class. There are lots of different kinds of ceramics. There are three specific properties of ceramics that are important. One is that they can withstand high temperatures, they have good insulating properties, which is why prominent in electrical devices and in some applications they have good durability.

When you come to the question of the ceramic engine, I believe what is being talked about is the use of ceramics—because of both their high temperature and insulating properties—to make what is called an adiabatic engine. This means that none of the energy that is now released through the coolant to the radiator will go there. It will instead go to the exhaust gas.

I would like to point out to the committee that making a perfectly adiabatic engine will not give any increase in fuel economy. When fuel burns in an engine it releases heat. Part of the heat is converted to mechanical energy, which is what drives the vehicle. Part of the heat is released through the coolant to the radiator and then to the atmosphere, and part of the heat remains in the exhaust gas. If you had a perfect ceramic engine, none of the heat would be released to the coolant and to the radiator. All the heat would go to the exhaust gas. So by having a perfectly insulated engine you would get no additional mechanical energy unless you do something else. You have to get the heat out of the exhaust gas. That would require some turbomachinery.

Viewing the potential of a ceramic engine, it appears from a practical point of view or even a theoretical point of view that its real potential would be in heavy-duty diesel engines where the high cost of the initial engine is relatively small compared to the fuel economy gain. So in terms of ceramic engines, we think their promise is in heavy-duty diesel engines where they have a special need for fuel economy. The military has a special need for adiaba-

tic engines because this will reduce any tactical advantage of coolant loss.

Mr. GLICKMAN. The ceramics would avoid some wearability problems, would they not, in existing engines?

Dr. TUESDAY. Yes. That is where they show promise, but just for specific pieces of an engine, not for the engine per se. In terms of making the whole engine ceramic, that only appears to have——

Mr. GLICKMAN. Are you doing any additional work over and beyond what your Detroit Diesel Division is doing for the Department of Energy?

Dr. TUESDAY. On ceramics?

Mr. GLICKMAN. Yes.

Dr. TUESDAY. Yes. Ceramics are now in common use in automobiles. Spark plugs are made of ceramics. There is a sensor in all the exhaust pipes of GM-powered automobiles which is ceramic, and the catalyst substrate is ceramic. Our viewpoint, as I have expressed previously, is that the ceramic engine may have an application for heavy-duty use, but not for automotive use. We are also looking at the specific applications that ceramics might have because of their durability potential.

Mr. GLICKMAN. A recent report by the National Bureau of Standards indicates that well over $100 billion is expended annually due to fracture of materials. Muc f this cost is due to prevention and costly overdesign. Savings of about $60 billion annually could be achieved by applying available technology and through expanded research. Similar costs, about $70 billion a year and subsequent savings of about $35 billion result in corrosion or rust. I wonder if you might comment on that, and is your company pursuing research and applications in the areas of corrosion and fracture?

Dr. TUESDAY. First I will take corrosion. Yes, obviously since the main component of automobiles still is steel, and steel does corrode. We have been and are continuing to do research, both from a practical viewpoint, that is, ways to coat steel and prevent corrosion, as well as fundamental research investigating the chemical reactions that occur in corrosion. By fracture I guess you mean the broad term, fracture of metals, ceramics, and materials in general. That is one of the prime research topics that people working with metals, ceramics, and other materials are continuing looking at.

These are basic research programs that we hope will result in practical application. As far as the numbers you quoted are concerned, I have no feel for their accuracy.

Mr. GLICKMAN. Would you characterize General Motors' research work in these areas as substantial?

Dr. TUESDAY. I guess the question is, compared to what? Yes, it is substantial, yes.

Mr. GLICKMAN. As part of your research effort do you consider these high-priority issues?

Dr. TUESDAY. These are important aspects of material science research.

Mr. GLICKMAN. What more can be done in these areas?

Dr. TUESDAY. Again, presumably what is holding those areas up is some fundamental knowledge not yet acquired.

Mr. GLICKMAN. Do you think there is a role for industry-government collaboration to improve generic technologies such as the

ones we have mentioned in corrosion resistance and fracture resistance?

Dr. TUESDAY. No. I think the proper role for Government is in the realm of getting fundamental research, not in developing that knowledge into technology.

Mr. GLICKMAN. We thank you all for coming here and testifying.

This concludes our hearings on the issue. I might just mention a couple of things for the record. While the subject matter of these hearings has been rather technical, in my judgment it is not abstract. It relates to the survivability of this Nation as an industrial power. It relates to the creation and retention of hundreds of thousands of jobs throughout the United States in key industries which are suffering now and in industries which will be developing in the future. And one of the things that I think that have come out of this series of hearings is that the role of the Federal Government in determining materials needs is no better defined today than it has been for 10 or 15 or 20 years, but is becoming better defined in other nations.

I would hope that, realizing of course that it is up to the private sector to commercialize technologies and not the Federal Government, I would hope that, perhaps, through legislation we might be able to improve the institutional problems that exist in developing a role for what basic research is done in the Federal Government, how we cooperate between the Federal Government and the private sector in that research, and how better to commercialize those technologies. I think these hearings have proved useful in developing the basis for such legislation if we decide to go forth with it.

I thank the witnesses for coming here, and the hearing stands adjourned.

[Whereupon, at 11:05 a.m., the subcommittee was adjourned.]

[Additional statement submitted for the record follows:]

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SUBMITTED STATEMENT OF BILL CUNNINGHAM, ECONOMIST
DEPARTMENT OF ECONOMIC RESEARCH
AMERICAN FEDERATION OF LABOR AND CONGRESS OF INDUSTRIAL ORGANIZATIONS
BEFORE THE SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS OF THE COMMITTEE ON SCIENCE AND TECHNOLOGY ON FEDERAL GOVERNMENT RAW MATERIALS POLICY

June 24, 1983

The AFL-CIO is concerned about the need for a raw materials policy because of the growing dependence on imports of raw materials and the rapid decline in the health of the U.S. raw materials and processing industries. The AFL-CIO believes that a coordinated raw materials policy could restore the health of these industries and help stabilize employment and prices as well as provide adequate stockpiles of critical materials for an emergency. The range of materials considered as part of a raw materials policy should include all materials and processing industries that are critical for the proper functioning of our economy.

There is a need for overall coordination of raw materials policy. The proposals for a cabinet level policy to coordinate raw materials policy to replace the present decision-making structure would bring about an improvement in coordination. We believe, however, that such decision making should take place in the context of a comprehensive industrial policy, since many of the problems contributing to the decline of raw materials industries are the same as those affecting most of the nation's basic industries.

We believe that it is crucial for raw materials policy to include measures to help U.S. raw materials industry to deal with competitive pressure from abroad which has been greatly exacerbated by the protective practices of foreign governments and the seriously overvalued dollar. Other problems which must be addressed are the effects of high interest rates and the recession on raw materials industries.

We agree with those who recommend that the nation's raw materials policy should set goals and coordinate research and development efforts aimed at developing new materials and better processes to improve existing materials. We recognize that composite materials and new processes for improving the characteristics of metals hold much promise for reducing reliance on imports from insecure sources. Coordination of this kind of research may increase the efficiency and speed of developing these materials.

The problems of the nation's raw materials industries cannot be solved by the industries themselves. Most other nations recognize the need for government policy to keep their industries viable. Government policy to ensure the health of raw materials industries exists in other industrialized nations, including Japan, Germany, France and the U.K. These policies enable their industries to cope with problems beyond the control of a single company or industry. Such policies give industries in those countries a considerable competitive edge against the U.S. industry. Unless the U.S. adopts similar industrial policies, American industry will continue to flounder and become increasingly vulnerable to import competition.

Raw materials competition from underdeveloped countries commonly comes from nationalized mines, such as those in Chile, Zambia and Zaire. These countries subsidize production, particularly during recessions, to keep these mines operating for export which hurts mine production and employment in the U.S.

The problems that have arisen in copper demonstrate the magnitude of the problem. Before the recession, U.S. copper mines were producing at high capacity. The other major producers are Chile, Canada, Zambia and Zaire. In the face of recession-reduced demand for copper, Canadian and American

producers drastically cut back production. But production in Chile increased despite the decline in demand, and the Chileans captured about 20 percent of the non-Communist share of the world market, up from 17 percent 5 years ago. Zambian, Peruvian, and Phillipine production also did not decline during the recession. More than half the copper mining capacity in the U.S. and Canada was idled as governments in developing countries kept their government-owned mines going. The government of Chile reportedly puts forth a heavy subsidy to keep their mines going.

The success of mines in developing countries is due in part to U.S. aid and foreign lending by U.S. banks and international lending institutions. A recent Los Angeles Times article tells the story of the loss of 11,000 copper mining jobs in Arizona, while 20 miles away a Mexican mine is booming in part due to U.S. assistance.

The closure of mines and cutbacks in production had disastrous consequences for employment in copper mines in the U.S. In the context of American law, the harm to American mines would be considered illegal and predatory behavior; but because it is the result of policies of other nations, no action has been taken, and the destruction of jobs and production continues.

The capacity for processing copper ore in the U.S. has also declined greatly in recent years. Copper ore is exported from the U.S. to Japan for processing, and then the finished copper is imported from Japan back to the U.S. Copper smelters in the U.S. have been allowed to deteriorate, and some have been closed down.

Employment in the steel industry has declined from 420,000 in 1980 to 242,000 in 1983, and imports have captured 26 percent of the American steel market. The decline in the steel industry is a long-term trend as well as a result

of the current recession. Forecasters do not expect steel employment to regain its pre-recession level.

In some cases, steel companies appear to be abandoning the effort to maintain their market share using their capital instead to invert in other lines of business. U.S. steel raised $6 billion to buy Marathon Oil at the expense of building more modern steel capacity.

Steel is considered vital and is, therefore, heavily protected and subsidized by foreign governments. The U.S. steel industry is a victim of such practices and will continue to decline unless the government takes action to turn the situation around. In normal times with less slack in steel capacity, even a small percentage of imports could have serious consequences for prices and supply.

The aluminum industry has suffered heavy unemployment during the current recession. The industry has been expanding outside the country, and policies of other nations encourage U.S. companies to construct new capacity abroad at the expense of the U.S. expansion. Jamaica has structured taxes on American companies to penalize them for cutting production. This has given American companies the incentive to close American plants and reduce production in order to keep their Jamaican facilities operating. Government policies must be established to prevent the loss of the U.S. aluminum market to imports.

The nation's strategic stockpiles are considerably short of the goals that have been set for these stockpiles. The Administration's budget restrictions and large deficits are a factor in the slow progress in raising these stockpiles to more reasonable levels, and most stockpiled materials will remain well below their goals under current policy. Raising the stockpiles of domestically produced materials would be especially appropriate at this time in view of the large

unemployment and excess mining capacity that now exists. Raising stockpiles at this time would give some relief to these industries, allow the government to take advantage of the lower prices that now prevail, and allow the government to build stockpiles that could later be used to reduce the pressure on prices that will occur when the economy returns to a more healthy state.

The stockpile of copper, for example, is inadequate. Purchases of copper at this time could improve production and employment in the nation's copper mines. Sales from the stockpile in more prosperous times could help alleviate shortages and help prevent price surges.

Raw materials policy should also consider the effect of export of scarce materials on U.S. industry. Steel scrap, stainless steel scrap, and logs have been exported in the past at a time when these materials were in short supply pushing up prices and damaging U.S. industries in need of these materials. Logs were exported in high volume to Japan in the 1970s even though the exports caused unemployment in U.S. sawmills because the logs were unavailable. We believe the Japanese imported the logs as a matter of policy because they did not want to import finished lumber from the U.S.

Scrap materials are an important source of materials in U.S. industry and can be processed at a much lower cost than the ores themselves. The intense bidding on scrap materials in better times creates a substantial inflationary pressure in the American economy. The export of stainless steel scrap was allowed even though chrome was being imported from insecure sources. Each ton of stainless steel scrap contains about 40 pounds of chrome.

We recommend that raw materials policy include a policy for stockpiling agricultural goods to help deal with the inflationary problems in this sector. The food-price spiral was set off by surges in grain exports preceded by the set

aside of agricultural acreage. Export of agricultural goods has been very volatile with little coordination of production, stockpiles, and exports. The AFL-CIO recommends the creation of a grain board like the board that exists in Canada to oversee exports and manage a stockpile of adequate size to prevent exports from having an inflationary effect. The actions of such a board would be consistent with overall raw materials policy.

Energy policy, under the current Administration, has reduced the commitment to bring about energy self-reliance. The Administration has allowed the synfuels effort to collapse and has dismantled some energy conservation programs and has reduced funds for others. The slack in the world oil market will disappear when more normal economic activity is restored, and the U.S. will again become vulnerable to oil import disruptions and sharply rising prices.

U.S. companies cannot by themselves cope with the forces that are contributing to the decline of American raw materials and processing industries. They cannot compete with government subsidies given to foreign competitors and the nationalized industries in foreign countries. Nor can private industry cope with the vagaries of the exchange rate problem, the increased costs due to high interest rates, and the recession. We believe that the U.S. should deal with these problems in the framework of an industrial policy.